FURUNO

OPERATOR'S MANUAL

GPS NAVIGATOR

MODEL GP-500 MARK-2

FURUNO ELECTRIC CO., LTD.
NISHINOMIYA, JAPAN

©FURUNO ELECTRIC CO., LTD.

9-52, Ashihara-cho,
Nishinomiya, Japan

Telephone: 0798-65-2111
Telefax: 0798-65-4200

·Your Local Agent/Dealer

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⚠ SAFETY INSTRUCTIONS

"**DANGER**", "**WARNING**" and "**CAUTION**" notices appear throughout this manual. It is the responsibility of the operator and installer of the equipment to read, understand and follow these notices. If you have any questions regarding these safety instructions, please contact a FURUNO agent or dealer.

⚠ **DANGER**	This notice indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
⚠ **WARNING**	This notice indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ **CAUTION**	This notice indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or property damage.

SAFETY INFORMATION FOR THE OPERATOR

⚠ WARNING

Do not open the cover of the equipment.

This equipment uses high voltage electricity which can shock, burn or cause death. Only qualified personnel should work inside the equipment.

Do not dissasemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the ship's mains switchboard if water or foreign object falls into the equipment or the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire, electrical shock or serious injury.

⚠ CAUTION

Do not place liquid-filled containers on the top of the equipment.

Fire or electrical shock can result if a liquid spills into the equipmtnt.

Do not place heater neat the equipment.

Heat can melt the power cord, which can result in fire or electrical shock.

Do not operate the unit with wet hands.

Electrical shock can result.

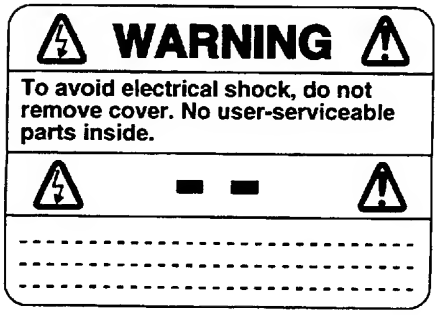
Use the correct fuse.

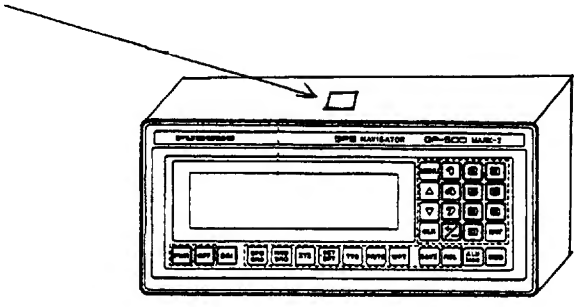
Use of the wrong fuse can cause fire or equipment damage.

No single navigation aid (including this unit should ever be relied upon as the exclusive means for navigating your vessel.

The navigator is responsible for checking all aids available to confirm his position. Electronic aids are interded to assist, not replace, the navigator.

WARNING Label attached





Name : Warning Label (1)
Type : 86-003-1011-0
Code No. : 100-236-230

SAFETY INFORMATION FOR THE INSTALLER

WARNING

Only qualified personnel should work inside the equipment.

This equipment uses high voltage electricity which can shock, burn, or cause death.

Turn off the power at the ship's mains switchboard before beginning the installation. Post a warning sign near the switchboard to ensure that the power will not be applied while the equipment is being installed.

Serious injury or death can result if the power is not turned off, or is applied while the equipment is being installed.

CAUTION

Ground the equipment.

Ungrounded equipment can give off or receive electro-magnetic interference or cause electrical shock.

Confirm that the power supply voltage is compatible with the voltage rating of the equipment.

Connection to the wrong power supply can cause fire or equipment damage. The voltage rating appears on the label at the rear of the equipment.

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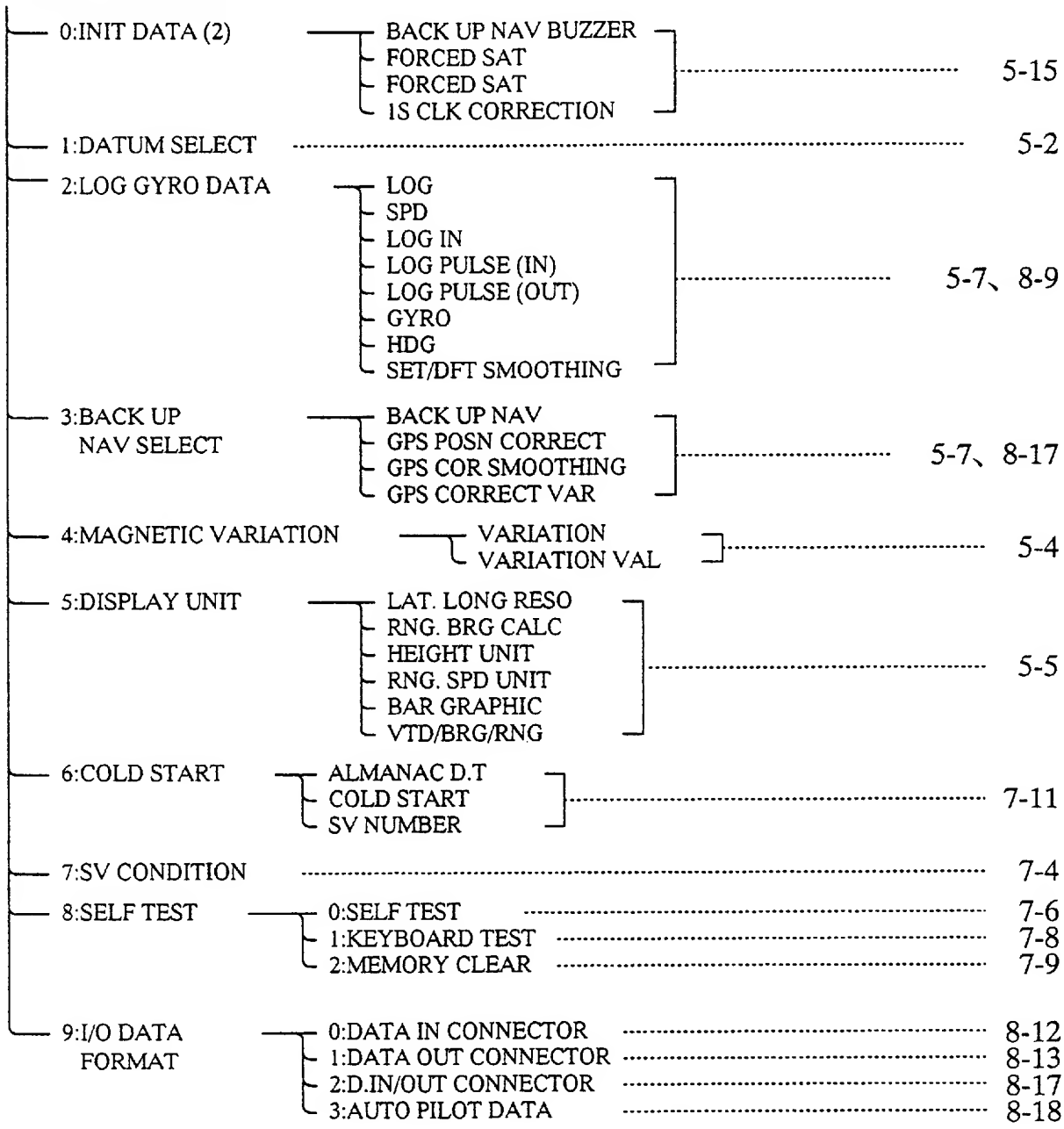


FOREWORD

Congratulations on your choice of the FURUNO GP-500 MARK-2 GPS Navigator. We are confident you will see why the FURUNO name has become synonymous with quality and reliability.

For over 40 years FURUNO Electric Company has enjoyed an enviable reputation for innovative and dependable marine electronics equipment. This dedication to excellence is furthered by our extensive global network of agents and dealers.

Your unit is designed and constructed to meet the rigorous demands of the marine environment. However, no machine can perform its intended function unless properly installed and maintained. Please carefully read and follow the installation, operation and maintenance procedures set forth in this manual.

We would appreciate hearing from you, the end-user, about whether we are achieving our purposes.

Thank you for considering and purchasing FURUNO equipment.

NOTICE: *No single navigational aid (including this unit) should ever be relied upon as the exclusive method for navigating your vessel. The navigator is responsible for checking all aids available to confirm his position. Electronic aids are meant to assist the navigator.*

Features

The GP-500 MARK-2 consists of two units: an antenna unit and a display unit. The high sensitivity, eight channel receiver tracks up to eight satellites simultaneously. An 8-state Kalman filter ensures optimum accuracy in determination of vessel position, course and speed.

Navigation data is presented on a 240 × 64 dot matrix backlit LCD. Data shown are ship's position in latitude and longitude, speed and course, range and bearing to a waypoint, etc.

In most cases the operator need do no more than turn on the power to find his or her position.

The unit operates from any 10 to 40 Vdc power supply. 100 V, 110 V, 200 V or 220 Vac, 50/60 Hz operation also is available by an optional rectifier. Power consumption is 12 W.

The GP-500 MARK-2's compact size belies the multitude of features contained inside. The main features are as follows.

- Compact display unit permits installation where space is limited
- Comprehensive display of navigation data
- Storage for up to 200 waypoints
- Reception of data from DGPS beacon receiver in RS-232C or RS-422
- Navigation planning from/to waypoint or routes
- Alarm functions -- Arrival alarm, Anchor Watch alarm, Cross Track Error alarm, Border alarm, Ship's Speed alarm, Trip alarm
- Man overboard feature records latitude and longitude coordinates at time of man overboard and provides continuous updates of the range and bearing to that point
- Built-in self diagnosis

How to Use this Manual

This manual is laid out in as "user-friendly" a manner as possible. A sophisticated instrument such as this, with its many, many functions can be very intimidating to the first-time user. It is our intention to guide the user along in the use of the gear as gently and as comfortably as possible in a series of sections that start a very basic level and proceed forward in complexity in a logical manner.

This manual is arranged as follows:

Chapter 1 provides an introduction to GPS.

Chapter 2 covers basic operations. In most cases all you need to do to fix your position is turn on the power.

Chapter 3 explains waypoint navigation. A waypoint is the most basic information required to find information such as range and bearing from your vessel to a point.

Chapter 4 provides the information necessary for route navigation. A route is a sequence of waypoints leading to your ultimate destination.

Chapter 5 covers miscellaneous functions, such as how to enter earth's magnetic variation and how to display position in Loran TDs.

Chapter 6 describes the alarm functions.

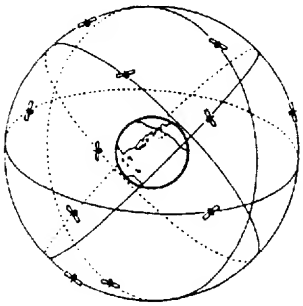
Chapter 7 provides troubleshooting information. Whenever you feel your unit is not operating properly, refer to this chapter.

Chapter 8 covers installation.

The **Appendix** contains specifications, time differences map, geodetic chart systems stored in this unit, etc.

INTRODUCTION TO GPS

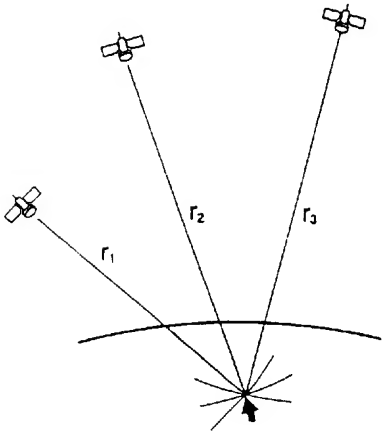
What is GPS?



GPS is an acronym meaning Global Positioning System. GPS (sometimes referred to as NAVSTAR) is a highly precise satellite navigation system developed by the U.S. Department of Defense.

When full global coverage becomes available, a constellation of 24 satellites emplaced in nearly 20,000-kilometer high 12-hour circular orbits will provide highly precise, continuous, worldwide, all-weather position plus time and velocity information to GPS receiver-equipped vehicles, vessels and aircraft.

Figure 1-1 The orbits of GPS satellites



The GPS receiver's position is continuously fixed by receiving 3 (or 4) satellites in line-of-sight of the GPS receiver. The basic steps in position fixing are as below.

1. GPS satellites continually transmit their own precise orbital data called ephemeris. The GPS receiver computes satellites' position by this data.
2. The GPS receiver measures very accurate distance to the satellites.
3. Satellite locations and their distances from the GPS receiver are known. The GPS receiver fixes its own position by triangulation.

Figure 1-2 How the GPS receiver finds its position

Position-fixing accuracy (HDOP)

In radar position-fixing, most accurate position fixes are obtained when the targets used are spaced nearly 90 degrees from each other. Similarly, GPS position fixing accuracy is subject to satellite location. Generally, the further apart the satellites are from one another, the greater the position-fixing accuracy.

For example, take a look at Figure 1-3. In both situations a fix is obtainable in the Northern Pacific region because three satellites are in line-of-sight. However, accuracy will be higher in the right-hand figure since the satellites are spread farther apart than the satellites in the left-hand figure.

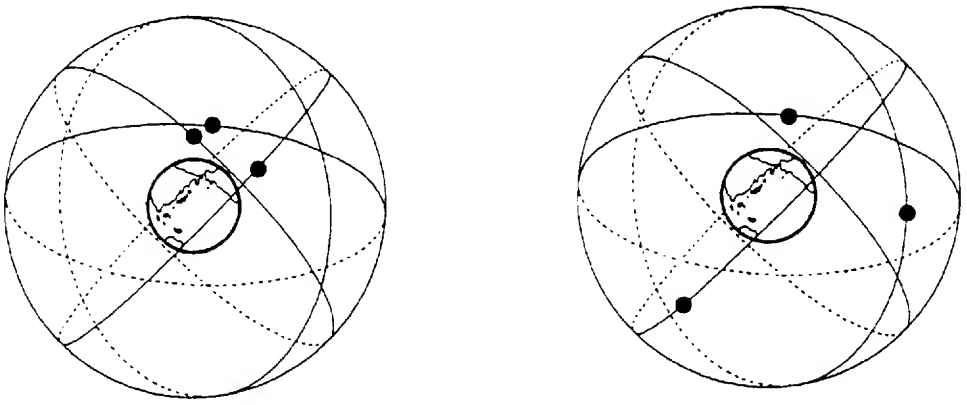
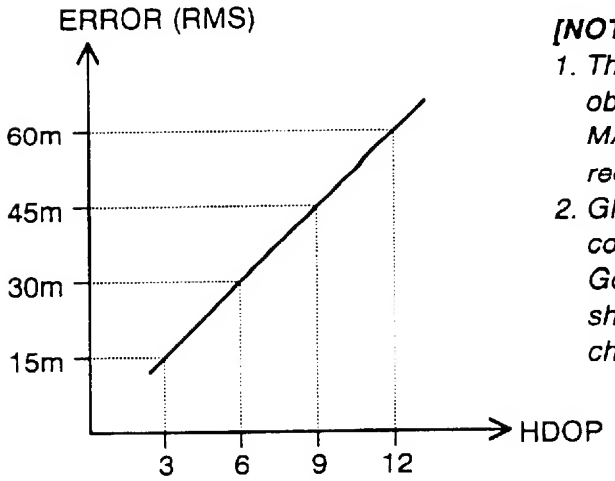


Figure 1-3 Satellite positions and accuracy of position fix

The index for position-fixing accuracy is known as HDOP (Horizontal Dilution of Precision). In simpler terms it is the geometrical relationship among 3 (or 4) satellites. The higher the HDOP value the less accurate the position fix. The error in distance is proportional to the HDOP value as shown in Figure 1-4.



[NOTE]

1. *The error shown is observed on the GP-50 MARK-2 under favorable receiving conditions.*
2. *GPS accuracy is controlled by the US Government. The error shown is subject to change.*

Figure 1-4 HDOP rate and position error

■ **NOTE:** *In this manual HDOP is referred to as DOP.*

BASIC OPERATION

This chapter provides basic operating information, from turning on the power to saving present position.

The first time the GP-500 MARK-2 is turned on it needs about 2 minutes to fix its position. This is because there is no almanac stored in the unit. Subsequent power applications require about 20 seconds.

If the position displayed when turning on the power is more than 10 degrees (about 600 miles) different from your actual position you should enter your estimated position, to find your exact position much quicker.

The Keyboard

The keyboard consists of 30 color-coded keys. Each time you press a key the associated reaction can be seen on the screen almost immediately.

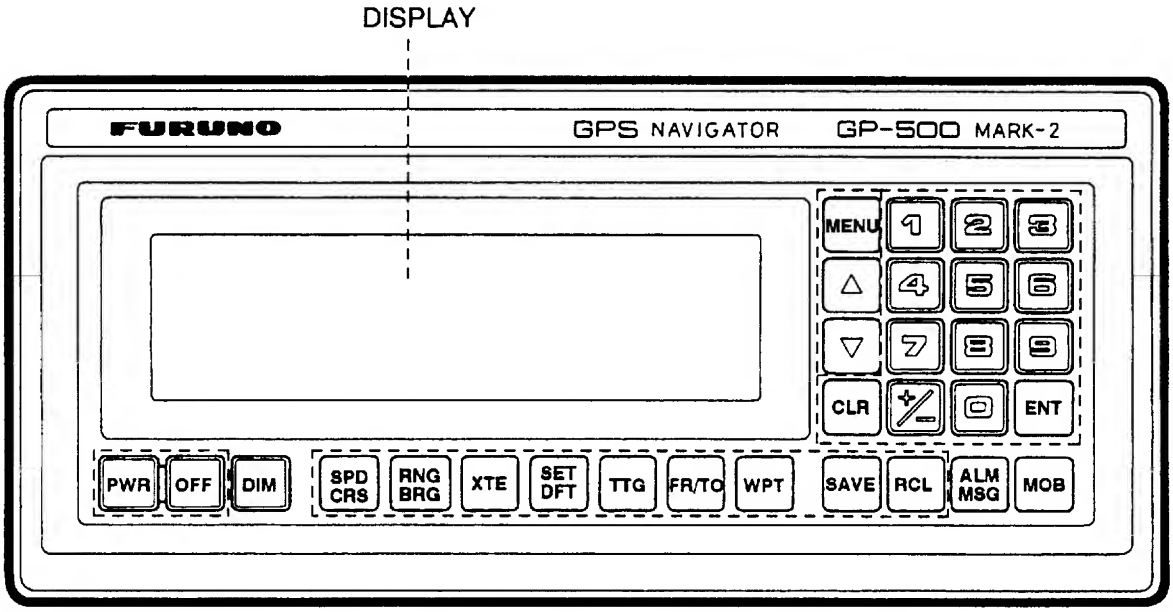


Figure 2-1 GP-500 MARK-2 Display Unit

Key description

Table 2-1 describes the function of each key.

Table 2-1 Key description

Key	Function
MENU	Display menu.
0 to 9	Enter numeric data.
▲▼ (Arrow)	Set cursor on line where to enter data.
CLR	Clear wrong or previously entered data.
+/ –	Change coordinate from North to South, East to West, or vice versa.

Key	Function
ENT	Terminate keyboard input.
PWR	Turn on the power.
OFF	Press together with **PWR** to turn power off.
DIM	Adjut keyboard backlighting and LCD brightness.
SPD CRS	Display speed and course.
RNG BRG	Display range and bearing from present position to TO waypoint.
XTE	Display cross track error from present position to TO waypoint.
SET DFT	Display speed and direction of water current.
TTG	Display time-to-go (and estimated time of arrival) from FROM waypoint to TO waypoint.
FR/TO	Select FROM and TO waypoints.
WPT	Register waypoint.
SAVE	Save present position.
RCL	Display saved position.
ALM MSG	Display alarm source.
MOB	Mark man overboard position.

Keyboard response conventions

Each time you press a key the unit emits a beep tone according to operation executed.

- High tone beep -- Key input accepted.
- Low tone beep -- Invalid key input.

Basic Operating Procedures

Turning the power on and off

To turn the power on, press the PWR key.

To turn the power off, press the PWR and OFF keys together.

Adjusting illumination and backlighting

Press the DIM key to adjust the backlighting of the keyboard and the brighness of the LCD, in four levels.

Entering numeric data

Press numeric keys 0 - 9.

Changing latitude and longitude coordinate

Press +/- to change North to South, East to West, or vice versa.

Clearing data

Before entering any data you press the CLR key to clear previous data. This key can also be used to clear wrong data.

Terminating keyboard input

Press the ENT key.

The Main Menu

Many functions of the GP-500 MARK-2 are carried out through the main menu. Press the **MENU** key to display the main menu. The main menu consists of nine sub menus, numbered 0 through 9.

```
MENU
SELECT NUMBER : 0~9
 0:INITIAL DATA(1)      5:ROUTE
 1:TIMER                6:ALARM
 2:TIMER SET            7:FUTURE SATELLITES
 3:WAYPOINT             8:DIFFERENTIAL DATA
 4:VOYAGE PLAN          9:SYSTEM DATA
```

Figure 2-2 Main menu

Menu description

Table 2-2 provides a brief description of the menus.

Table 2-2 Menu description

Menu	Function
0: INITIAL DATA (1)	Enter initial setting such as estimated position and antenna height.
1: TIMER	Start the timer/stopwatch.
2: TIMER SET	Preset timer/stopwatch and wake-up time.
3: WAYPOINT	Register waypoints.
4: VOYAGE PLAN	Determine the shortest course between two waypoints.
5: ROUTE	Register and select route.
6: ALARM	Preset alarm ranges.
7: FUTURE SATELLITES	Display satellite schedule.
8: DIFFERENTIAL DATA	Enter DGPS data. Display DGPS receive status.
9: SYSTEM DATA	Enter system data such as magnetic variation and geodetic chart system.

Basic menu operation

The procedure which follows describes how to select a menu and enter data on a menu display.

1) Press the **MENU** key.

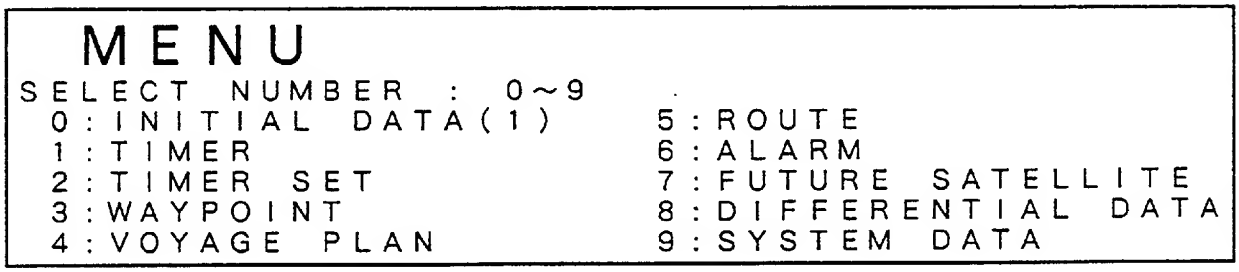


Figure 2-3 Main menu

2) Enter menu number with numeric keys. For example, press **0** for the INITIAL DATA (1) menu. The menu shown in Figure 2-4 appears.

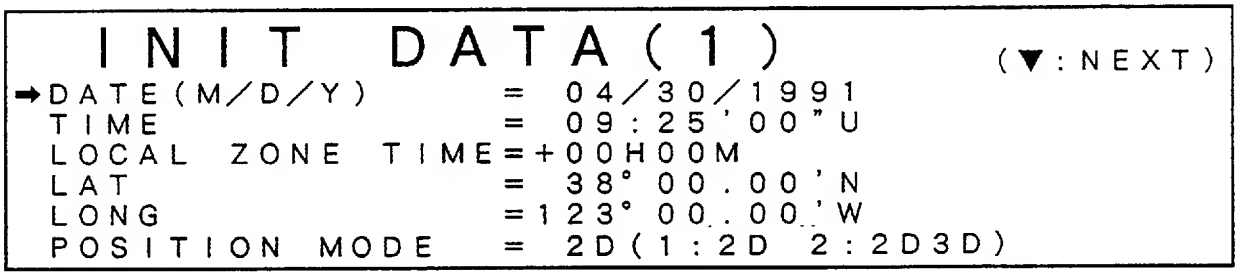


Figure 2-4 INIT DATA (1) menu

3) Press **▲** and **▼** keys to select line where you want to enter data. To enter latitude on the "LAT" line, for example, press **▼** three times to set the cursor on the LAT line. Your display should show the cursor on the LAT line, as in Figure 2-5.

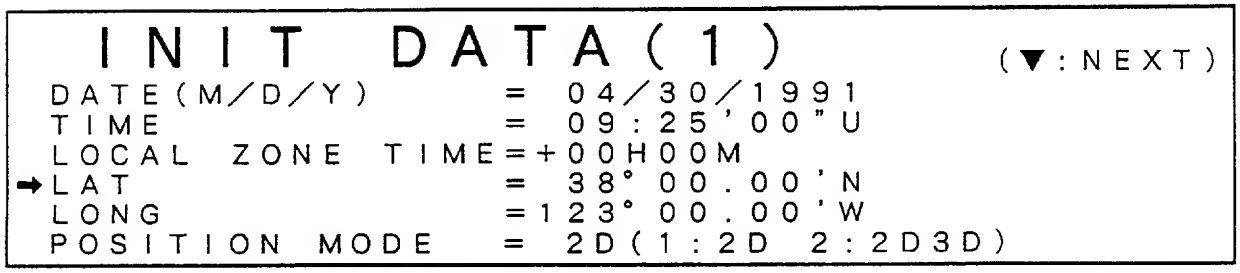


Figure 2-5 INIT DATA (1) menu

4) Press appropriate numeric keys to enter data. For example, to enter 5° 21. 34′ South latitude, press the following keys.

[CLR] [0] [5] [2] [1] [3] [4] [+/-] [ENT]

NOTE 1: *Arrow starts and stops blinking when* [CLR] *and* [ENT] *are pressed, respectively.*

NOTE 2: *Entry of leading zeroes is necessary.*

5) To enter data elsewhere on the current screen, press [▲] or [▼] to select line, and then enter data.

To escape, press [MENU] or any blue key.

Basic Start-up

Once initial settings are entered you need do no more than turn on the power to fix your position. If initial settings have not been entered, enter them by referring to the installation chapter.

Turn on the power

Press the **PWR** key to turn on the power. If this is the initial power application after installation the unit takes between 2 and 3 minutes to find its position. Subsequent power applications require about 20 seconds.

- When you turn on the power, "PF" (Power Failure) appears and blinks on the display. This does not mean equipment trouble. It will disappear upon pressing a key.
- If "BACK UP DATA ERROR" appears, see page 6-15.

Enter your estimated position

This is normally not required. If your position is more than 10 degrees different from the displayed position, however, enter your estimated position (within 10 degrees) as follows.

1) Press **SPD CRS** to confirm position. Then, press **MENU** and **0**.

```
  I N I T   D A T A ( 1 )                    (▼:NEXT)
➡DATE(M/D/Y)          =  04/30/1991
 TIME                 =   0:25'00"U
 LOCAL ZONE TIME=+09H00M
 LAT                  =  34°44.00'N
 LONG                 =123°00.00'W
 POSITION MODE        =  2D(1:2D 2:2D3D)
```

Figure 2-6 INIT DATA (1) display (first page)

2) Press **▼** three times to advance the cursor to the LAT line.

3) Enter estimated latitude by pressing the following keys.

CLR □□° □□.□□' (**+/-**)

4) Press the **ENT** key.

5) Press **▼**.

6) Enter estimated longitude by pressing the following keys.

CLR □□□° □□.□□′ (+/-)

7) Press the ENT key.

Enter antenna height

Correct input of the antenna height above the waterline is essential for accurate determination of position. If not already entered, enter it as follows.

8) Press the ▼ twice to advance the cursor to the ANTENNA HEIGHT line.

```
I N I T   D A T A ( 1 )                    ( ▼ : N E X T )

➡A N T E N N A   H E I G H T  =  5 m ( − 9 9 9 ~ 9 9 9 9 )
  M A S K   E L E V A T I O N  = 5 °   ( 0 5 ~ 9 0 )
```

Figure 2-7 INIT DATA (1) display (second page)

9) Enter antenna height above the waterline in meters, using four digits. If the height is 15 meters, for example, press CLR 0 0 1 5.

10) Press the ENT key.

11) Press the SPD CRS key to return to the position display.

The display shows "C ST," "ACQ" and "2D" in that order. "2D" is short for two-dimensional and appears when position information is reliable. It appears about 20 seconds after turning on the power in daily start-up.

NOTE 1: *"MASK ELEVATION" on the INIT DATA (1) display should not be changed. The default setting of 5 degrees provides excellent performance under all conditions. Adjustment may greatly lessen available GPS position fixing time.*

NOTE 2: *Input of time and date is not necessary. When you receive a satellite signal the correct date and time appear on the display.*

NOTE 3: *You can display time in UTC or local time. (The default setting is UTC.) If you prefer local time, enter time difference between your time and UTC on the "LOCAL TIME ZONE" line. If your time is earlier than UTC enter a minus sign before entering time difference. See page A-4 for reference.*

NOTE 4: *The default setting for "POSITION MODE" is 2D; that is, for marine vessels. For land vehicles, change to 2D3D. At the 2D3D mode, the two-dimensional position fix (2D) and three-dimensional position fix (3D) are automatically switched according to how many satellites are in line-of-sight; three satellites for 2D and four satellites for 3D. Also, when PDOP value exceeds 6 in the 3D mode, the position-fixing method is automatically changed to 2D.*

How to Read the Display

Any one of the five keys bracketed in Figure 2-8 show position when pressed.

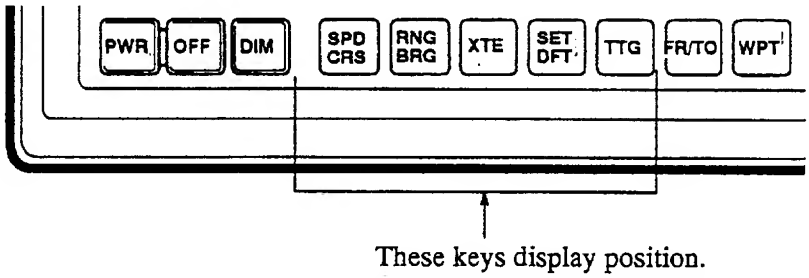


Figure 2-8 Keyboard, showing keys which display position

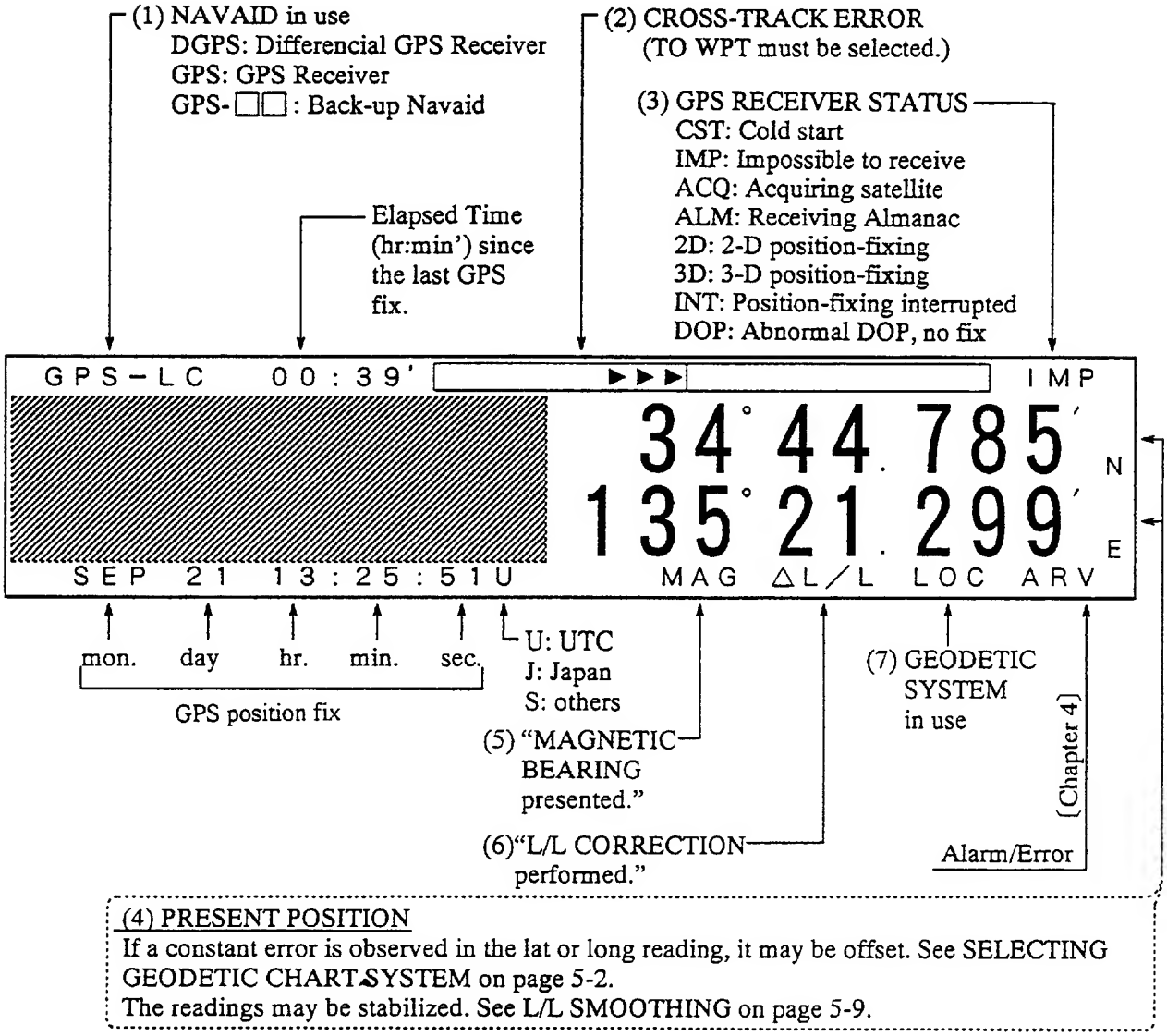


Figure 2-9 Typical position display

Detailed descriptions of items 1 through 7 in Figure 2-9 follow.

① Position-fixing system in use

Abbreviations	Meaning
GPS	Position fixing by GPS. The unit generates three beeps when GPS position fixing is no longer unavailable. (You can disable the buzzer if not required. More on this in a later chapter.)
GPS-A	Position fixing by dead reckoning; namely, speed log and gyrocompass.
GPS-M	Position fixing by manually entered speed and heading information.
***GPS-DR**	Position fixing by satellite navigator.
***GPS-LC**	Position fixing by Loran C receiver.
***GPS-LA**	Position fixing by Loran A receiver.
***GPS-OM**	Position fixing by Omega receiver.
***GPS-DC**	Position fixing by Decca receiver.
DGPS	Position fixing by DGPS.
– – –	No external navigator connection. (No fix)

NOTE: *The asterisk appears when no position correction is applied.*

② Cross track error

Cross track error is displayed with arrowheads. Up to ten arrowheads appear according to amount of cross track error. One arrowhead is equivalent to 0.02 nautical miles.

Course error

Course error between TO waypoint and your vessel's heading may be shown instead of cross track error. One arrowhead is equal to three degrees of course error.

To return your vessel to the intended track or course, steer in the direction indicated by the arrowheads.

③ Receiver status

Abbreviations	Meaning
C ST	This indication appears on the first power on after installation and means there is no almanac inside the unit. The unit automatically starts acquiring a satellite to receive the almanac. If you know a satellite which is within line-of-sight, conduct cold start as prescribed on page 7-11.
IMP	Impossible to receive. (A satellite is not available within line-of-sight.)
ACQ	The unit is acquiring a satellite. If the "ACQ" indication remains on the screen for a long time (without being replaced by ALM, 2D or 3D), suspect that the satellite is not being received normally.
ALM	The unit is receiving the almanac. According to the almanac in the GP-500 MARK-2 three satellites (four in case of 3D) are not yet available within line-of-sight. Since it cannot fix its position, the GP-500 MARK-2 is receiving the almanac.
2D or 3D	Two dimensional or three dimensional position fixing.
INT	Position fixing is interrupted. Objects near the GPS antenna are interrupting reception of satellites. Position fixing is resumed when lost satellite reappears.
DOP	When HDOP exceeds 4 in the 2D mode or PDOP exceeds 6 in the 3D mode, DOP value becomes abnormal and position fix is not reliable. The GP-500 MARK-2 automatically switches to the 2D mode when the PDOP exceeds 6 in the 3D mode.

④ Position

Latitude and longitude appear in the resolution level of either 0.01 or 0.001, depending on setting described on page 5-5. In case of 3D position fixing mode the antenna height above the waterline also appears.

⑤ Magnetic variation correction

"MAG" appears when the bearing is corrected by magnetic variation. No "MAG" means all bearings are true.

⑥ Latitude and longitude correction

Δ L/L appears to inform you to that latitude and longitude corrections are being applied to GPS position. (The GP-500 MARK-2 applies position correction only to GPS position.)

⑦ Geodetic system

"LOC" appears when a geodetic chart system other than WGS-84 is selected.

Saving Present Position

Man overboard position

Press the MOB key to mark man overboard position. The display should look something like Figure 2-10.

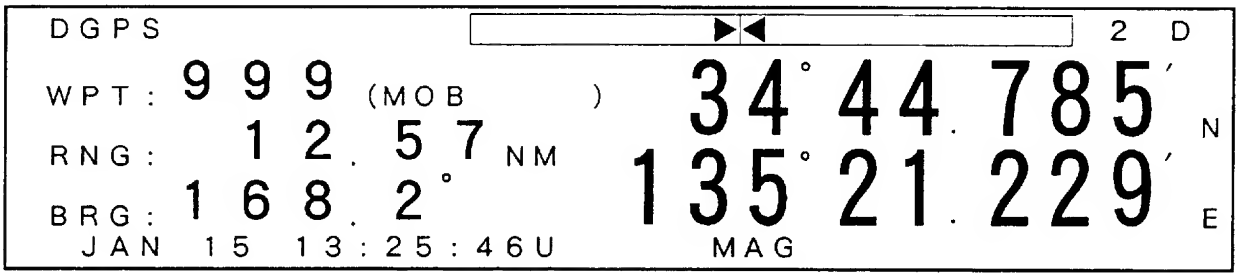


Figure 2-10 Typical man overboard display

The unit saves the position, time and date as "999." The range and the bearing from present position to the man overboard position are continually calculated, so you can easily return there. Figure 2-11 illustrates the man overboard feature.

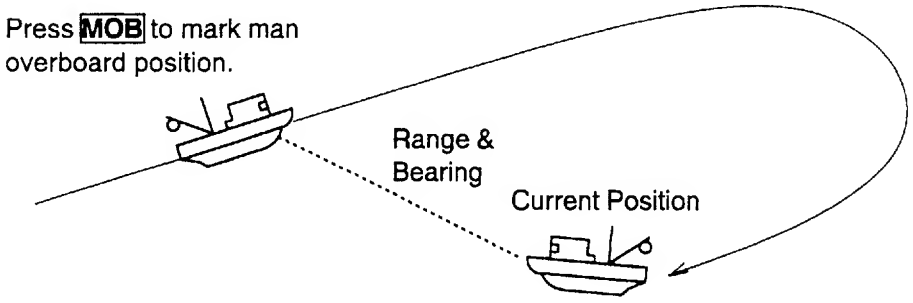


Figure 2-11 The man overboard feature

Present position

There will be times when you will want to save your present location on a temporary basis. (For permanent storage, register position as a waypoint. Waypoints will be dealt with in the next chapter.) For example, you have laid some crab pots, and want to return to the location at a later time.

You can save up to 20 present locations. The unit numbers the locations from 200 to 219. If you try to save more than 20 locations, the earliest locations will be deleted, one at a time, to make room for the latest positions.

Press the SAVE key. The moment the key is pressed the position of your vessel is stored in the memory. Figure 2-12 shows a typical SAVE INTO display.

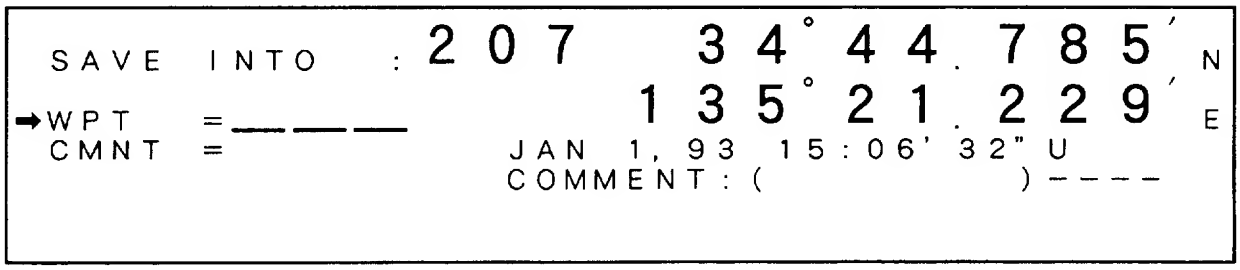


Figure 2-12 Typical SAVE INTO display

In the next chapter you will learn how to save present position as a waypoint.

Automatic position saving

This unit automatically saves the vessel's position on the hour. It numbers these locations from 300 to 319.

Viewing Saved Positions

You may view both manually and automatically saved positions by pressing the **RCL** key. Each time you press the key the position saved appears in the following sequence.

999→••201→ 200→ 999→ 319→••300→ 219→ 218→••

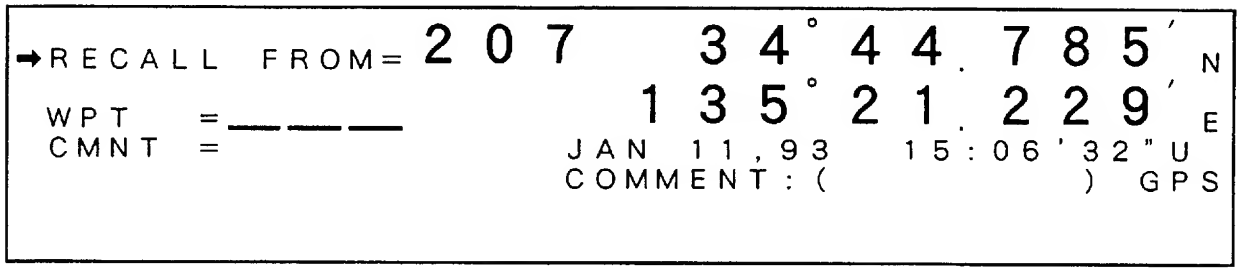


Figure 2-13 RECALL FROM display, showing manually saved position

WAYPOINT NAVIGATION

This chapter provides the information necessary for waypoint navigation. A waypoint is a particular location on a voyage, whether it be a starting point, an intermediate point or a destination point. Using a waypoint, the GP-500 MARK-2 can calculate various navigation information from the present position to the waypoint. These are

- range and bearing
- ideal course
- velocity to destination
- estimated time of arrival
- time-to-go, and
- cross track error or course error.

Registering Waypoints and Displaying Waypoint List

This unit has 199 waypoints into which you can enter position information. It numbers waypoints from 001 to 199.

Obviously, it's important that you write down your waypoints in a log so you have a permanent record of which waypoint is which.

There are five methods by which you can enter a waypoint:

- by latitude and longitude
- by present position
- by previously saved position
- by range and bearing from a previously registered waypoint, and
- by LOP (Line of Position) values for Loran C, Loran A or Decca.

By latitude and longitude

1) Press the **WPT** key. The display shown in Figure 3-1 appears.

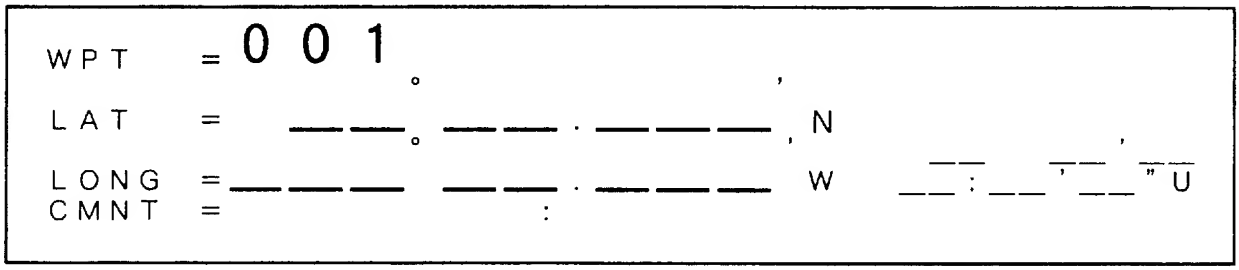


Figure 3-1 WPT display (no data)

2) Enter waypoint number (001 to 199).

CLR □□□

3) Press the **ENT** key.

NOTE: *If "LOCK" or "IN USE" appears on the display, this means the waypoint number is write protected or is selected as TO or FROM waypoint, respectively. For how to overwrite the waypoint number, see page 3-4.*

4) Press ▼.

5) Enter latitude.

CLR □□° □□.□□□'

6) Select coordinate polarity, North or South, by pressing +/-.

7) Press the ENT key.

8) Press the ▼.

9) Enter longitude.

CLR □□□° □□.□□□'

10) Select coordinate polarity, East or West, by pressing +/-.

11) Press the ENT key.

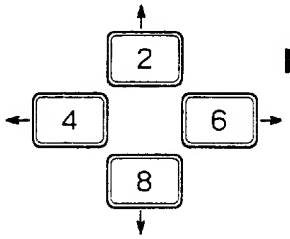
12) Press the ▼ key. The cursor moves to "CMNT."

```
➡CMNT  =

 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z          F I N I S H
```

13) You may enter a comment to help you identify the waypoint. The comment may consist of up to eight alphanumeric characters. To enter a comment;

(1) Press the CLR key. A highlighted cursor appears on character "A."
(2) The following numeric keys serve to move the cursor. Operate them to place the cursor on the character you want to enter. If the first character of your comment is "E," for example, press the [6] key four times to select "E."



NOTE: Below are all *the characters which can be entered for a comment. These characters appear on two pages. Use the [2] and [8] keys to scroll the display.*

```
 0 1 2 3 4 5 6 7 8 9 + − ; # ? $ % & = ~ * ! /_
 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
```

(3) Press the ENT key. The character selected appears on the prompt line.

(4) Repeat steps 2 and 3 to complete the comment.

(5) Press [6] to place the cursor on "FINISH."

(6) Press the ENT key.

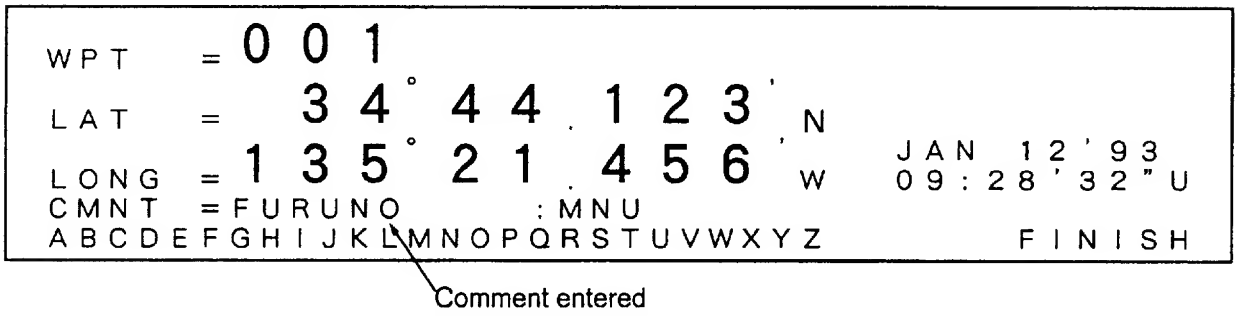


Figure 3-2 Typical WPT display

Write-protecting waypoints

You can write protect a waypoint as follows.

14) Press ▲ or ▼ to place the cursor on the first line.

15) Enter waypoint number (001 to 199) you want to write protect as follows;

CLR +/- □□□

Each press of the +/- key alternately displays and erases the indication "LOCK."

16) Press the ENT key.

NOTE: *As noted earlier the indication "LOCK" means a waypoint is write protected and respectively. You can disable the write protection on a waypoint by entering its number and then pressing the* +/- key twice to erase "LOCK." "IN USE" means the waypoint is being used in waypoint navigation, or as a starting point or waypoint when following a route.

By present position

1) Press the **SAVE** key. The display should look something like Figure 3-3.

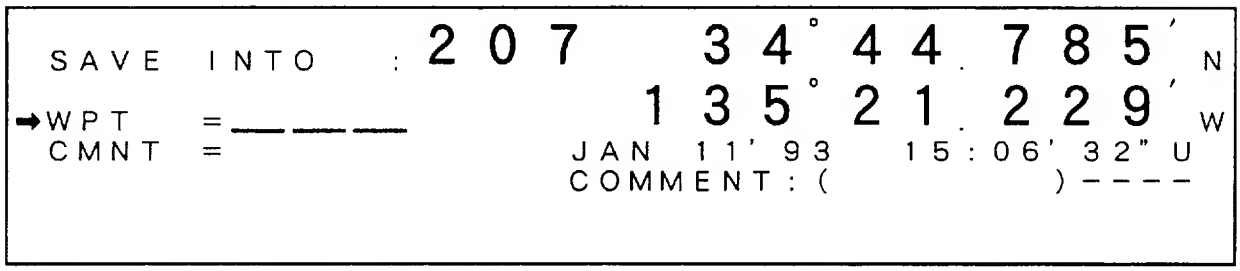


Figure 3-3 Typical SAVE INTO display

2) Enter waypoint number (001 to 199), in three digits.

3) Press the **ENT** key.

4) Press ▼.

5) Enter a comment if desired.

By previously saved position

You can register a waypoint by using a previously saved position.

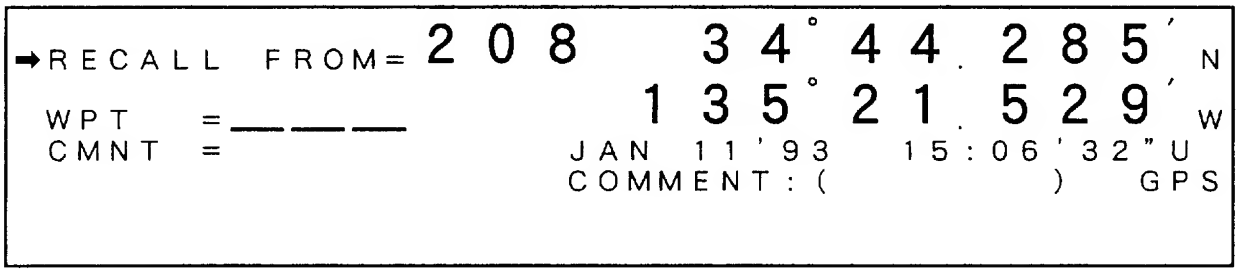


Figure 3-4 Typical RECALL FROM display

1) Press the **RCL** key several times to display the saved position you want to register as a waypoint.

2) Press ▼.

3) Enter waypoint number (001 to 199).

CLR□□□

4) Press the **ENT** key.

5) Press ▼.

6) Enter comment if desired.

By range and bearing

You can enter a waypoint by using range and bearing from a previously entered waypoint, or a point of which latitude and longitude are known.

1) Press [MENU], [3] and [2].

```
  R/B  TO  WAYPOINT
➡FROM  WPT        =  ---(000~199)
        LAT/LONG=    0° 00.000' N     0° 00.000' W
 TO     WPT        =  ---(001~199)
        LAT/LONG:    0° 00.000' N     0° 00.000' W
 RANGE             =     0.0NM
 BEARING           =     0.0°
```

Figure 3-5 R/B TO WAYPOINT display

2) Enter starting point.

① To use a previously entered waypoint as starting point;

[CLR][ ][ ][ ][ENT]

② To use latitude and longitude position as starting point;

[▼]

[CLR][ ][ ]° [ ][ ].[ ][ ][ ]' ([+/-])*1

*1: Press to change coordinate from North to South or vice versa.

[CLR][ ][ ][ ]° [ ][ ].[ ][ ][ ]' ([+/-])*2

*2: Press to change coordinate from East to West or vice versa.

[ENT]

3) Press [▼].

4) Enter waypoint number you want to register the waypoint under.

[CLR][ ][ ][ ][ENT]

5) Press [▼].

6) Enter range from starting point to waypoint.

[CLR][ ][ ][ ][ ].[ ][ENT]

7) Press [▼].

8) Enter bearing from starting point to waypoint.

[CLR][ ][ ][ ].[ ][ENT]

NOTE 1: *You can not register an intermediate waypoint on a route.*

NOTE 2: *To register a radar target as a waypoint, use present position "000" as starting point.*

By LOP

You can register a waypoint by Loran time differences (TDs) or Decca phase differences. Firstly, change to Loran or Decca LOP display as prescribed in Chapter 5. The procedure for entering LOPs is almost the same as entering latitude and longitude.

1) Press the [WPT] key.

2) Press the [+/-] key when the display is on the latitude and longitude in order to changes to LOP display.

3) The remaining procedure is the same as that for entering latitude and longitude.

Displaying the waypoint list

Press [MENU], [3] and [0]. The waypoint list appears on the display.

```
  WAYPOINT LIST                                  (+/-:DATE)
▲006(          ):  34° 37.351' N  135° 08.380' W
 007(          ):*34° 40.350' N  135° 18.630' W
 008(          ):  34° 16.620' N  135° 59.020' W
 009(          ):  34° 09.550' N  134° 49.190' W
 010(          ):*33° 38.010' N  134° 28.790' W
▼011(          ):  32° 01.00 ' N  135° 10.407' W
```

Figure 3-6 Sample WAYPOINT LIST, latitude/longitude page

NOTE: *Asterisk indicates write-protected waypoint.*
The [+/-] key functions to alternate display of the

latitude/longitude page and the date/time page.

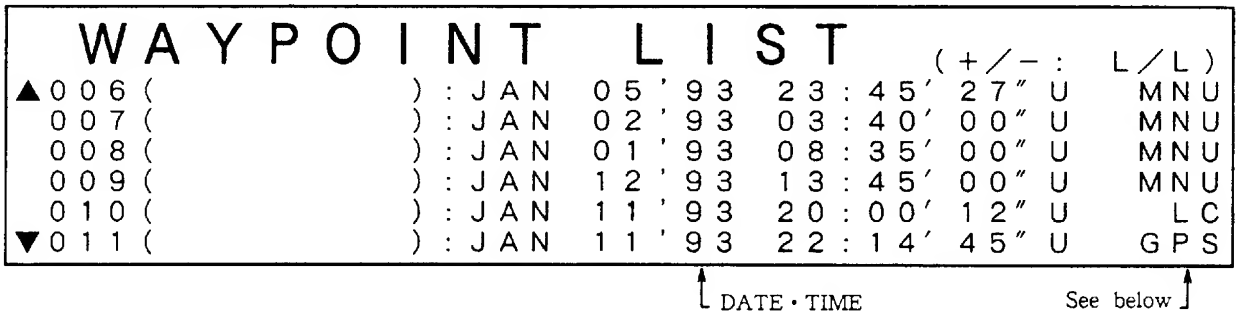


Figure 3-7 Sample WAYPOINT LIST, date/time page

Abbreviations used on the waypoint list

MNU···· Entered manually by latitude and longitude.
CLT····· Entered manually by range and bearing (latitude and longitude calculated).

For waypoints which are registered from saved or recalled position, the displays show the following:

GPS ····· GPS
GDR ····· Dead reckoning using speed and heading data
DR ····· Satellite navigator
LC····· Loran C
LA ····· Loran A
OM····· Omega
DC ····· Decca
DGPS···· Differential GPS

--- ····· No navigator nor GPS. Also appears if position is fixed by GPS when DOP is inferior to DOP threshold.

You can scroll the waypoint list with ▲ and ▼.

Waypoint Navigation

The GP-500 MARK-2 can calculate best course between two waypoints or a waypoint and present position. In addition, it calculates the following:

- the range and bearing
- ideal course
- velocity to destination
- the estimated time of arrival
- the time-to-go to arrival
- cross track error, and
- course error.

Specifying present position as FROM waypoint

1) Press the **FR/TO** key. The display should look something like Figure 3-8.

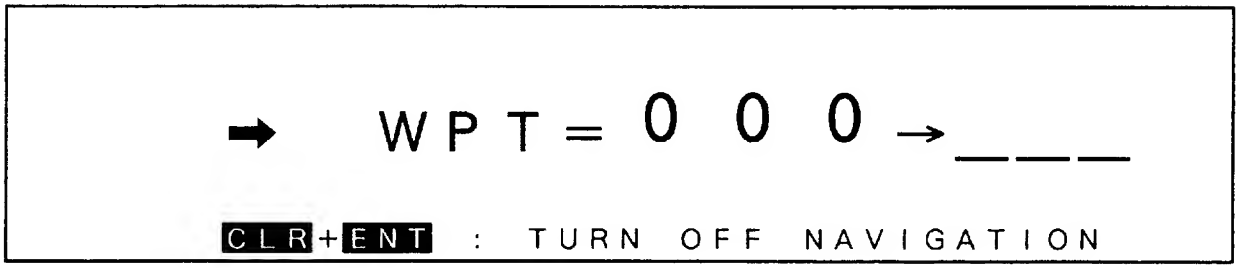


Figure 3-8 FR/TO display

2) Enter "TO" waypoint number (001 to 199), in three digits.

3) Press the **ENT** key.

The GP-500 MARK-2 automatically assigns present position as waypoint 000. Then, range and bearing from present position to the TO waypoint appear on the display.

Specifying registered waypoints as FROM and TO waypoints

1) Press the **FR/TO** key. The FR/TO display appears.

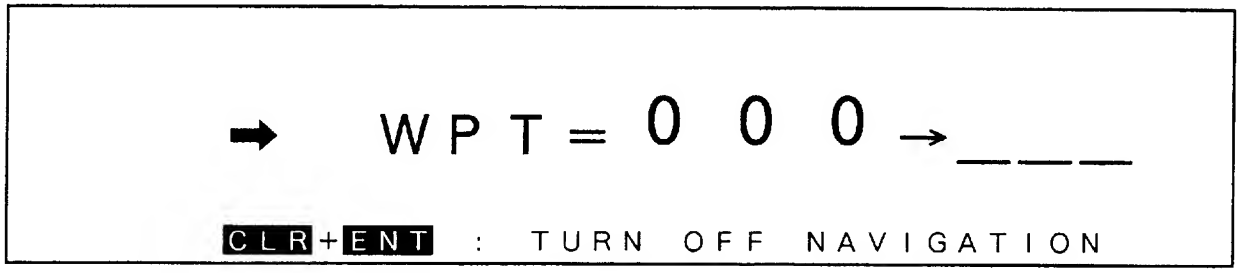


Figure 3-9 FR/TO display

2) Press the **CLR** key.

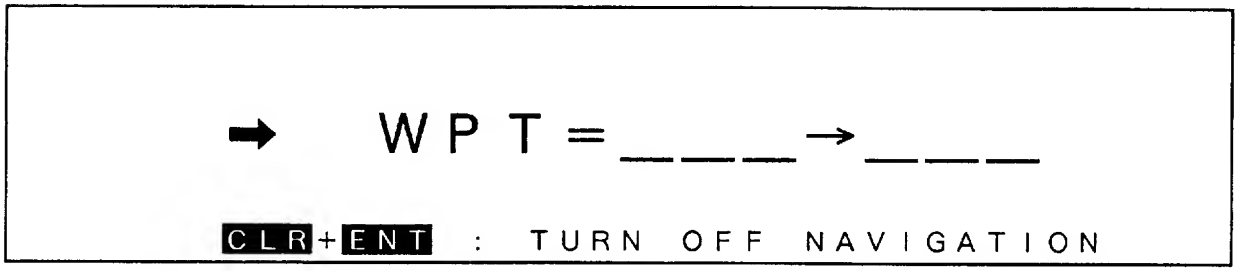


Figure 3-10 FR/TO display

3) Enter FROM waypoint number (001 to 199).

4) Enter TO waypoint number.

5) Press the **ENT** key. Then, range and bearing from the FROM waypoint to the TO waypoint appear on the display.

Canceling waypoint navigation

1) Press the **FR/TO** key.

2) Press the **CLR** key.

3) Press the **ENT** key. The range and bearing display appears, showing no information on the range and bearing lines.

Navigation and steering information

The GP-500 MARK-2 displays various navigation and steering information when you select TO and FROM waypoints.

Cross track error

A straight line connecting the TO and FROM waypoints is called the track. It could just as well be called the intended track because although it is the navigator's intention to follow the track line, in reality, he never can do so perfectly because of wind, current, etc.

The amount your vessel is off track is called cross track error. You can display cross track error to the TO waypoint by pressing any of SPD CRS, RNG BRG, XTE, TTG or SET DFT keys.

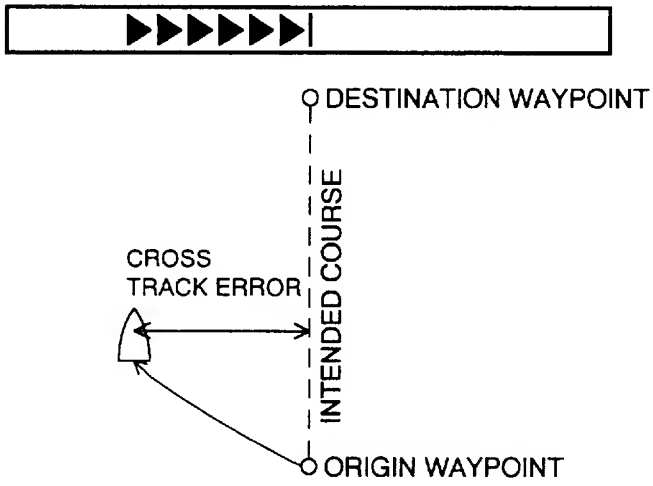


Figure 3-11 Cross track error display and graphic interpretation of cross track error

- The number of arrowheads changes with the amount of cross track error. One arrowhead is equal to 0.02 nautical miles of cross track error.

- To return your vessel to its intended track, steer in the direction and amount indicated by the arrowheads.

NOTE: *You can display course error instead of cross track error. Course error is the difference between the course and bearing. You will learn how to do this in Chapter 5.*

Speed, course and velocity to destination

Press the **SPD CRS** key. Each time you press the key one of the following displays appears.

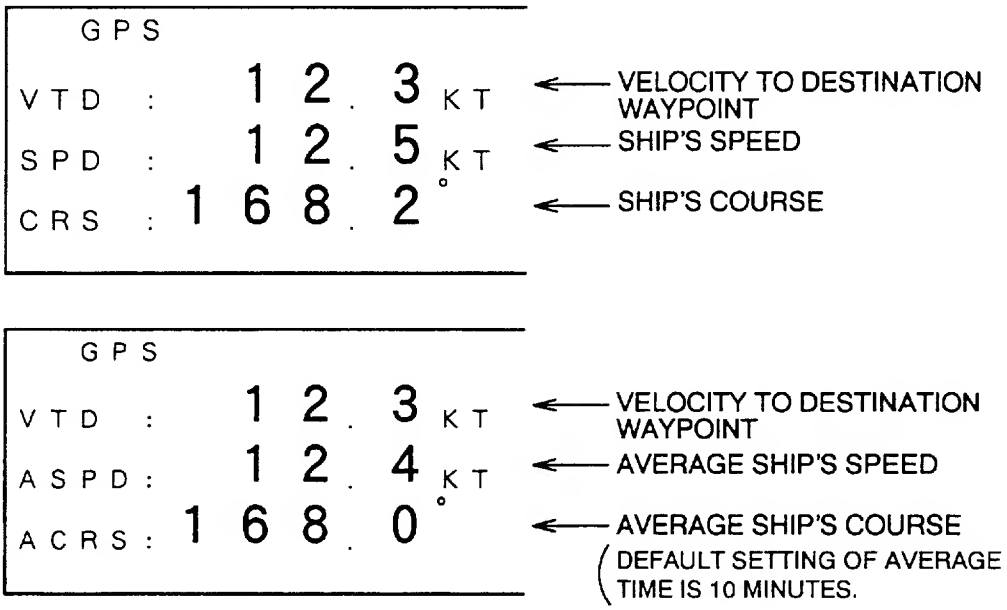


Figure 3-12 Typical speed and course display

When your vessel has deviated from its intended course (to the TO waypoint), there are two speed components: speed and velocity to destination.

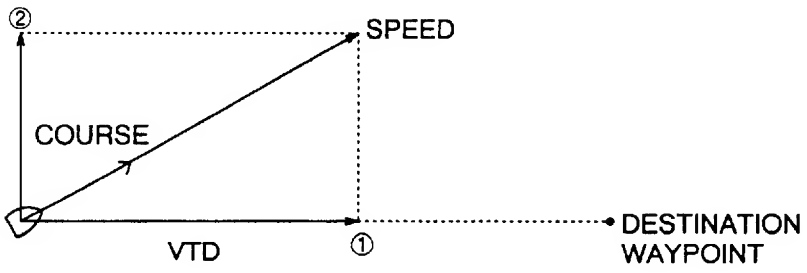


Figure 3-13 Graphic interpretation of velocity to destination

NOTE 1: *When your vessel passes the TO waypoint a negative speed is displayed as VTD. You can display range or bearing to TO waypoint instead of VTD. (See page 5-5.)*

NOTE 2: *The speed and course are true ones. They differ from water-tracking speed and heading which are typically measured by a speed log and a gyrocompass, respectively. Take a look at Figure 3-14. The ship's heading is due North, but the ship's*

direction has deviated to three degrees, due to water current. In this case the heading is 0 degrees and the course is 3 degrees.

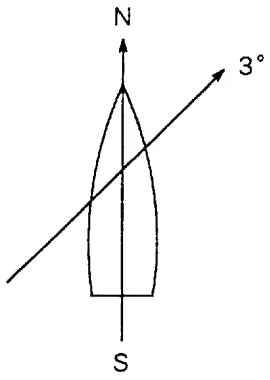


Figure 3-14 Heading and course

NOTE 3: *When GPS position fixing is unavailable, the unit displays speed and course information taken from external navigator. If dead reckoning is selected, the speed and heading information are fed from a speed log and gyrocompass respectively, or manually entered through the keyboard.*

NOTE 4: *When your vessel is cruising at extremely low speed the course reading may change by as much as 180 degrees because of minute error in speed measurement. This is not an indication of equipment trouble.*

NOTE 5: *Speed and course readings can be "smoothed." More on this in Chapter 5.*

Range and bearing

Press the **RNG BRG** key.

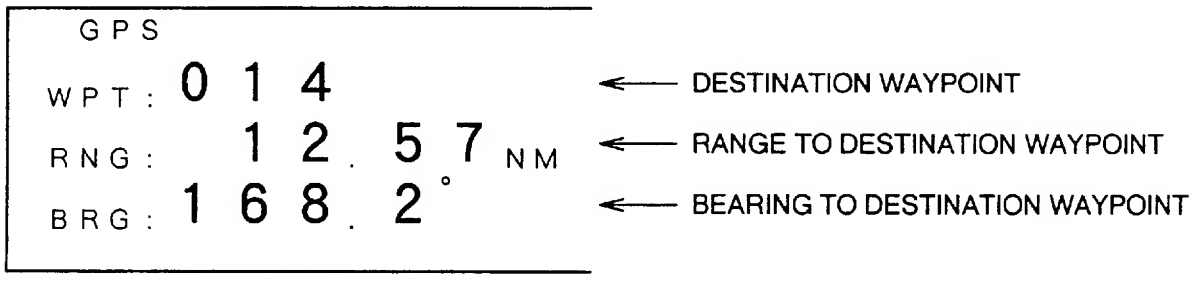


Figure 3-15 Typical range and bearing display, showing waypoint number and range and bearing from present position to waypoint

NOTE: *If you are navigating a route, the following display appears.*

Cross track error and course error

Press the **XTE** key.

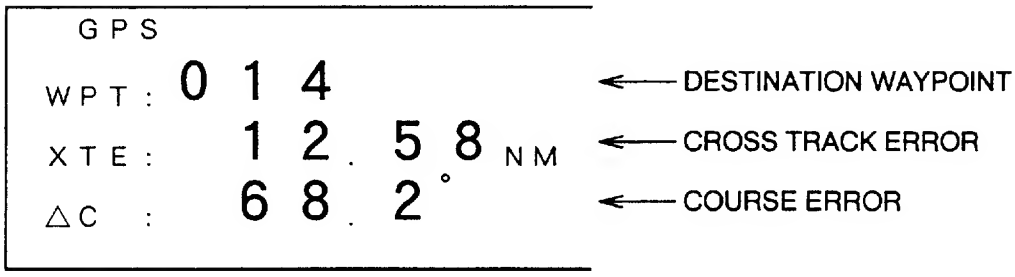


Figure 3-16 Typical XTE and course error display

A straight line connecting the FROM and TO waypoints is called the track. When your vessel is thrown off track by wind, etc., the amount in nautical miles the vessel is straying from its intended course is called the cross track error or XTE and the deviation angle is called course error. Course error is the difference between the course and bearing. You can display cross track error and course error by pressing the **SPD CRS** and **RNG BRG** keys, respectively.

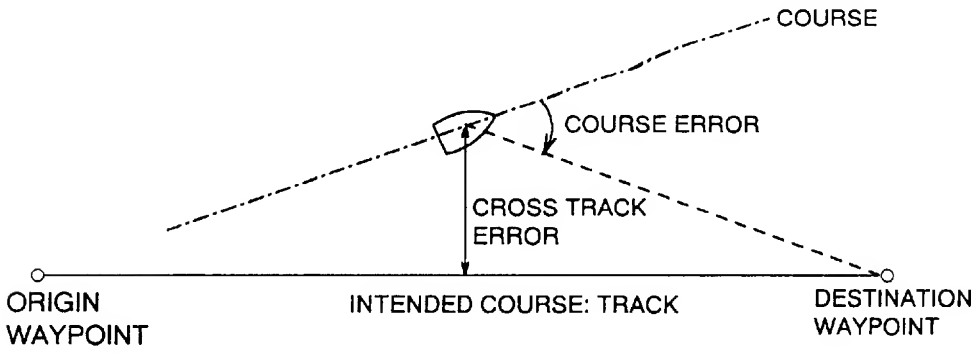


Figure 3-17 Graphic interpretation of course error and cross track error

Course error is also shown by bar graph. One arrowhead on the graph is equal to three degrees of course error.

Set and drift

Press the **SET DFT** key.

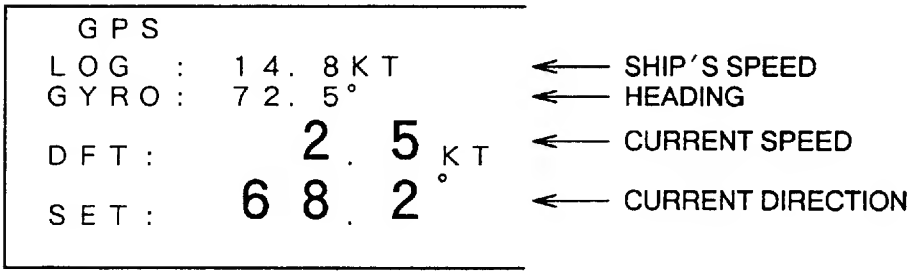


Figure 3-18 Typical set and drift display

True velocity is measured during GPS position fixing. Relative velocity; that is, water tracking speed and heading, are fed from a speed log and gyrocompass, respectively. The drift and set are calculated as the difference between the true and relative velocities.

NOTE 1: *As a speed information, you can select speed log, manually entered speed, or NMEA 0183 data fed from an external navigator.*

NOTE 2: *Set and drift display is available only during GPS position fixing.*

NOTE 3: *Similar to course readings, set and drift readings may abruptly change when ship's speed is reduced. Chapter 5 explains how to smooth set and drift readings.*

Time-to-go

Press the **TTG** key.

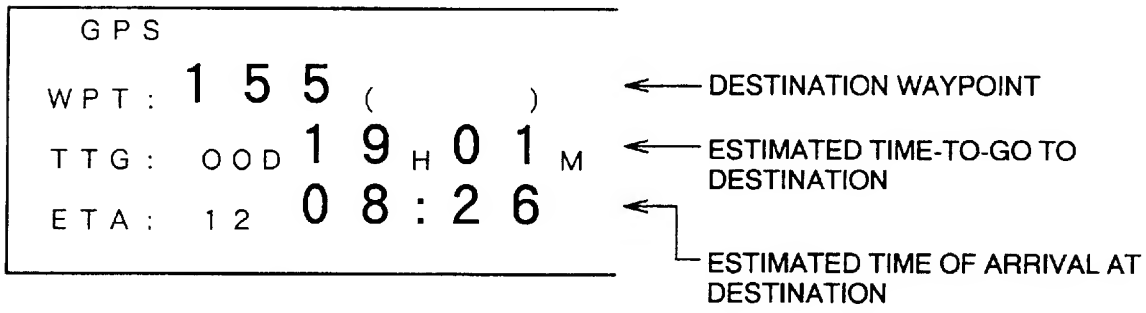


Figure 3-19 Typical TTG display

The TTG display shows the time remaining to reach the TO waypoint, maintaining current course and speed. Estimated time of arrival is also shown.

Displaying distance run

Press **MENU**, **6** and **1**. The distance run appears.

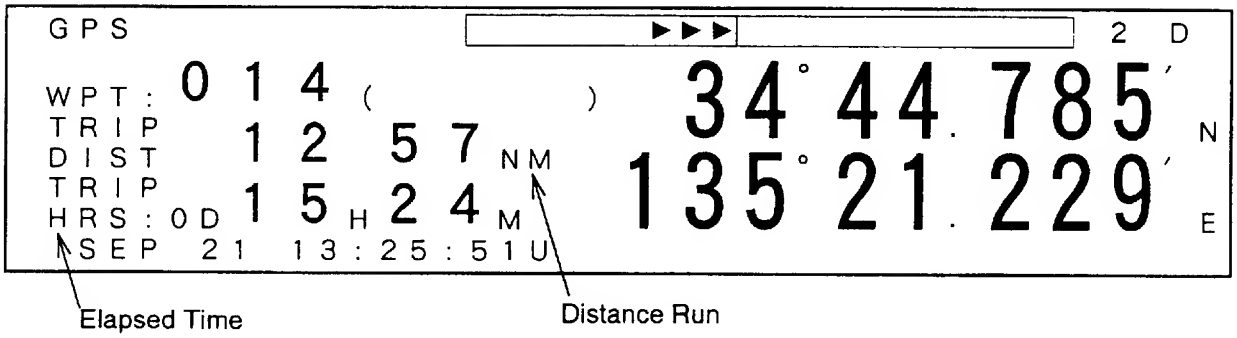


Figure 3-20 Distance run display

The distance run and elapsed time are reset to zero when you reset the TRIP RANGE to zero on the ALARM display. (See page 6-9.)

Calculating Range and Bearing Between Two Points

1) Press [MENU], [3] and [1]. The CALCULATION display appears.

```
   C A L C U L A T I O N   ( 1 )
➡F R O M   W P T        =  - -  ( 0 0 0 ~ 1 9 9 )
           L A T / L O N G =   0° 0 0 . 0 0 0′ N     0° 0 0 . 0 0 0′ W
  T O      W P T        =  - -  ( 0 0 0 ~ 1 9 9 )
           L A T / L O N G =   0° 0 0 . 0 0 0′ N     0° 0 0 . 0 0 0′ W
```

Figure 3-21 CALCULATION (1) display

2) Enter starting waypoint number (001 to 199).

Specifying registered waypoint as FROM waypoint

(1) Enter waypoint number (001 to 199).

[CLR] □□□

(2) Press the [ENT] key.

(3) Press [▼] twice.

Specifying latitude and longitude as FROM waypoint

(1) Press [▼].

(2) [CLR] □□° □□.□□□′ ([+/-])

(3) □□□° □□.□□□′ ([+/-])

(4) Press the [ENT] key.

(5) Press [▼].

3) Enter TO waypoint.

Specifying registered waypoint as TO waypoint.

(1) Enter waypoint number (001 to 199).

CLR □□□

(2) Press ENT.

Specifying latitude and longitude as TO waypoint.

(1) Press ▼.

(2) CLR □□° □□.□□□' (+/-)

(3) □□□° □□.□□□' (+/-)

(4) Press the ENT key.

The range and bearing by great circle or rhumb line calculation appear on the display.

```
➡RESULTS  RHUMB  LINE    :   232.9NM  320.7°
          GREAT  CIRCLE:   232.1NM  321.6°
```

Figure 3-22 Sample range and bearing calculation between two points

GREAT CIRCLE AND RHUMB LINE COURSES

The great circle course is the shortest path between two locations on the earth. It is usually used for long range navigation such as transoceanic voyages. To follow this course faithfully the helm must be steered continuously.

The rhumb line course is the pseudo shortest path between two locations on a chart. To follow a rhumb line course, the heading may be fixed if the distance is short.

You can select which course calculation method to use. More on this in a later chapter.

Calculating TTG and ETA Between Two Points

1) Press [MENU], [3] and [3]. The CALCULATION display appears.

```
  C A L C U L A T I O N   ( 2 )
➡F R O M   W P T        =  - -  ( 0 0 0 ~ 1 9 9 )
          L A T / L O N G =   0° 0 0 . 0 0 0 ' N     0° 0 0 . 0 0 0 ' W
  T O     W P T        =  - -  ( 0 0 0 ~ 1 9 9 )
          L A T / L O N G =   0° 0 0 . 0 0 0 ' N     0° 0 0 . 0 0 0 ' W
  S P E E D            =  1 0  K T ( 0 0 1 ~ 9 9 9 )
```

Figure 3-23 CALCULATION (2) display

2) Enter starting waypoint number (001 to 199).

Specifying registered waypoint as FROM waypoint

(1) Enter waypoint number (000 to 199).

[CLR] □□□

(2) Press the [ENT] key.

(3) Press [▼] twice.

Specifying latitude and longitude as FROM waypoint

(1) Press [▼].

(2) [CLR]□□° □□.□□□' ([+/-])

(3) □□□° □□.□□□' ([+/-])

(4) Press the [ENT] key.

(5) Press [▼].

3) Enter TO waypoint.

Specifying registered waypoint as TO waypoint.

(1) Enter waypoint number (000 to 199).

CLR □□□

(2) Press ENT.

Specifying latitude and longitude as TO waypoint.

(1) Press ▼.

(2) CLR □□° □□.□□□′ (+/-)

(3) □□□° □□.□□□′ (+/-)

(4) Press the ENT key.

4) Enter ship's speed for calculation (0 knot to 999 knot).

The TTG and ETA calculation appear on the display.

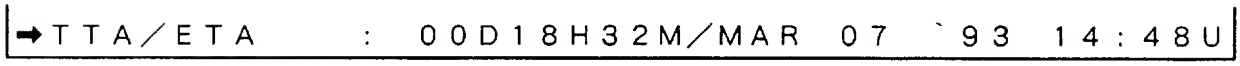


Figure 3-24 Sample TTG and ETA calculation between two points

ROUTE NAVIGATION

In many cases a trip from one place to another involves several course changes, requiring a series of route points (waypoints) which you navigate to, one after another. The sequence of waypoints leading to the ultimate destination is called a route. The GP-500 MARK-2 can automatically advance to the next waypoint on a route, so you do not have to change the destination waypoint repeatedly.

NOTE: *The route planning function is a very useful and beneficial function to have available. However, the ability to switch waypoints automatically during a voyage can lead to some very dangerous situations. The use of any navigational aid requires constant exercise of common sense and caution. FURUNO Electric Company will assume no responsibility for any damages associated with use of the route navigation function.*

Creating a Route

You can store up to 10 routes. The unit numbers them 01 to 10. Each route may consist of up to 10 waypoints. Route number 00 is a special one. More on this later.

Be sure to record all important routes in a separate log. This unit is not a fail-safe record keeping device.

1) Press **MENU**, **5** and **0**. The ROUTE PLAN display appears.

```
  ROUTE  PLAN                          (+/-:RANGE)
➡ROUTE NO   =  --   (00~10)
 SPEED      =  10.0KT      (000.1~999.9)
 0)WPT=---:  --° --.---' N  ---° --.---' W  ---
 1)WPT=---:  --° --.---' N  ---° --.---' W  ---
 2)WPT=---:  --° --.---' N  ---° --.---' W  ---
 3)WPT=---:  --° --.---' N  ---° --.---' W  ---
```

Figure 4-1 ROUTE PLAN display

2) Enter route number.

CLR [ ][ ] **ENT**

NOTE: *You cannot write over or delete a route which is currently used for route navigation.*

3) Press **▼**.

4) Enter starting waypoint number.

CLR [ ][ ][ ] **ENT**

5) Press **▼**.

6) Repeat steps 4 and 5 to enter other waypoints for the route.

The **+/-** key functions to alternately display comments, range from FROM waypoint and ETA from FROM waypoint.

```
  ROUTE  PLAN                          (+/-: L/L)
 ROUTE NO   =  03  (00~10)
 SPEED      =  10.0KT      (000.0~999.9)
 0)WPT=013(YARMOUTH)   ----.-NM  --D--H--M
 1)WPT=027(SABLE   )   134.5NM   0D23H44M
 2)WPT=045(HALIFAX )   267.8NM   1D43H56M
➡3)WPT=011(CANSO    )   483.5NM   2D07H00M
```

Deleting a Route and Route Contents

Deleting a route

1) Press MENU, 5 and 0. The ROUTE PLAN display appears.

```
ROUTE PLAN                                    (+/-:RANGE)
ROUTE NO  = 03   (00~10)
SPEED     = 10.0KT      (000.0~999.9)
0)WPT=013: 34°26.320'N 135 13 950'W MNU
1)WPT=027: 34°16.623'N 135 59 023'W MNU
2)WPT=045: 34°07.950'N 134 49 260'W MNU
➡3)WPT=011: 34°04.451'N 134 36 328'W *LC
```

Figure 4-2 ROUTE PLAN display

2) Enter the route number you want to delete.

CLR [ ] [ ] ENT

NOTE: *You cannot delete or write over a route which is currently begin used for route navigation.*

3) Press CLR and ENT.

Deleting route contents

1) Press MENU, 5 and 0.

2) Enter route number.

CLR [ ] [ ] ENT

3) Press ▲ and ▼ to select waypoint you want to delete.

```
ROUTE PLAN                                    (+/-:RANGE)
ROUTE NO  = 03   (00~10)
SPEED     = 10.0KT      (000.0~999.9)
0)WPT=013: 34°26.320'N 135 13 950'W MNU
➡1)WPT=027: 34°16.623'N 135 59 023'W MNU
2)WPT=045: 34°07.950'N 134 49 260'W MNU
3)WPT=011: 34°04.451'N 134 36 328'W *LC
```

Figure 4-3 ROUTE PLAN display

In Figure 4-3, waypoint 027 will be deleted from route number 3.

4) Press CLR and ENT.

The route is reorganized excluding the waypoint deleted. (The deleted line remains blank.)

Registering Route 00

The GP-500 MARK-2 provides a navigation calculator, called voyage plan, which determines the shortest distance between two points. You specify the starting, destination and number of intermediate points. Then, the GP-500 MARK-2 calculates the great circle among waypoints and generates intermediate waypoints on the route at equal distances. The thus generated route is route 00. This function is especially useful for long range navigation.

1) Press **MENU** and **4**. The VOYAGE PLAN display appears.

```
  VOYAGE  PLAN
➡FROM  WPT          =---        (001~199)
 TO    WPT          =---        (001~199)
 NO  OF  WPT        =   -       (   1~9   )
 SPD  FOR  CALC     =  --.-KT   (00.1~99.9KT)
 ROUTE  NUMBER      :  00
 RESULTS
```

Figure 4-4 VOYAGE PLAN display

2) Enter starting waypoint number (001 to 199).

CLR □□□ **ENT**

3) Press **▼**.

4) Enter destination waypoint number (001 to 199).

CLR □□□ **ENT**

5) Press **▼**.

6) Enter number of intermediate waypoints, up to nine, in one digit from 1 to 9.

CLR □ **ENT**

7) Press **▼**.

8) Enter speed to use for calculation of time-to-go.

CLR □□□ **ENT**

To enter 10.5 knots, for example, press **1**, **0** and **5**.

9) Press [▼]. The cursor is on the RESULTS line.

10) Press [▼]. The display shows the results of the calculation.

```
  VOYAGE  PLAN (RESULTS)
 WPT   (FROM)    : 012
 LAT/LONG        : 47° 00.000' N 100° 00.000' W
 RNG/BRG         : ----.-NM  ---.-°
 TTG             : --D--H--M
 TOTAL RNG/TIM   : ----.-NM  ---D--H--M
➡RESULTS
```

Figure 4-5 VOYAGE PLAN display (results)

11) Press [▼] to view automatically generated waypoints.

```
  VOYAGE  PLAN (RESULTS)
 WPT   (FROM)    : P01
 LAT/LONG        : 48° 46.478' N 101° 23.145' W
 RNG/BRG         : 103.2NM  178.6°
 TTG             : 0D05H27M
 TOTAL RNG/TIM   : 103.2NM  0D05H27M
➡RESULTS
```

Figure 4-6 VOYAGE PLAN display (results), showing automatically generated waypoint

- The unit numbers them from P1 to P9. Further pressing of [▼] displays other automatically generated waypoints in forward order. Press the [▲] key to display them in reverse order.

Modifying calculation results

If an island exists on route no. 00, for example, you can modify the latitude and longitude of a point to avoid the island.

1) Select the point you wish to change.

2) Press [▲] and [▼] to set the cursor on the LAT/LONG line.

3) [CLR] □□° □□.□□□'

4) Press [+/-] to change latitude coordinate, if necessary.

5) □□□° □□.□□□'

6) Press [+/-] to change longitude coordinate, if necessary.

7) Press the [ENT] key.

Following a Route

This section shows you how to select and follow a route. Suppose that you have registered the route shown in Figure 4-7.

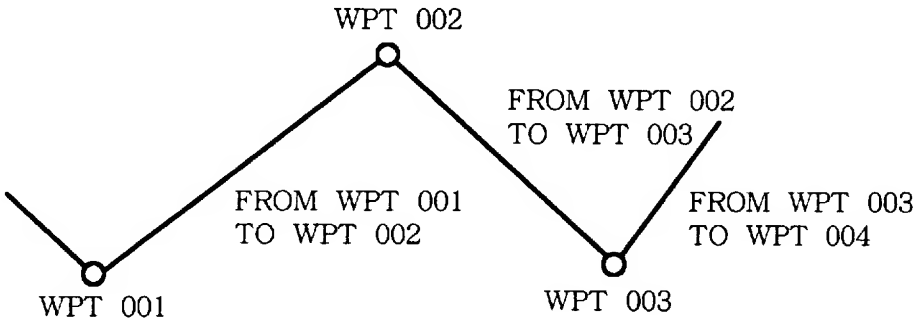


Figure 4-7 Sample route

When following a route you do not have to manually change the FROM and TO waypoints; the GP-500 MARK-2 changes them automatically upon arrival at a TO waypoint.

The unit switches waypoint when your vessel enters the alarm range set for the arrival alarm. The default setting is 0.5 nautical miles. You will learn how to change the arrival alarm range in Chapter 6.

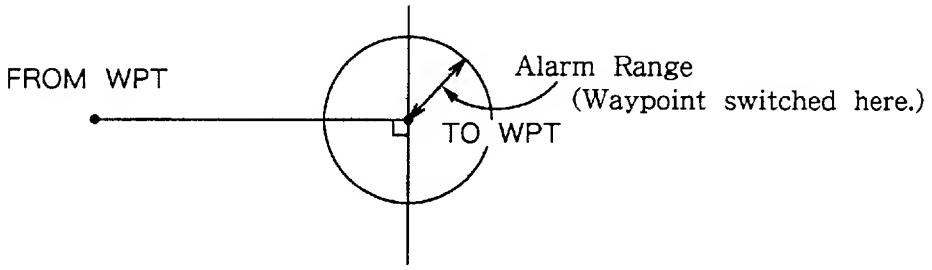


Figure 4-8 When the unit switches waypoints

Selecting a route

1) Press **MENU**, **5** and **1**. The ROUTE SELECT display appears.

```
ROUTE SELECT (+/-: WPT UPDT)
➡ROUTE NO    = --   (00~10)
 ROUTE NAV   = FORWARD
               (1:REVERSE  0:FORWARD)

 DISABLE WPT= ---
```

Figure 4-9 ROUTE SELECT display

2) Enter route number (00 to 10).

CLR [ ] [ ] ENT

3) Press ▼.

4) Enter direction in which to traverse the route waypoints; forward or reverse. Enter 0 for forward; 1 for reverse.

If you want to omit specific waypoints;

5) Press ▼.

6) CLR [ ] [ ] [ ] ENT

The unit recalculates the route excluding waypoint(s) disabled. It shows disabled waypoints in reverse video. If you want to enable the waypoint, enter its number as prescribed above.

```
ROUTE SELECT                    (+/-: WPT UPDT)
➡ROUTE NO      = 03    (00~10)
 ROUTE NAV     = FORWARD
                  (1:REVERSE  0:FORWARD)
 ROUTE03(000→005)
 005→014→008→045→027→116→039→112→113→114
 DISABLE WPT=  ---
```

Figure 4-10 ROUTE SELECT display, showing disabled waypoint in reverse video

When you select a route;

Present position is registered as waypoint 000 and is the FROM waypoint. The initial TO waypoint is the first waypoint on the route.

Manual change of FROM and TO waypoints

As mentioned earlier, the FROM and TO waypoints are automatically changed when your vessel enters the arrival alarm zone. If the alarm zone range is set too tight, however, FROM and TO waypoints will not be changed. You can do it manually by displaying the ROUTE SELECT display and pressing the +/- key.

In the display shown in Figure 4-10, for example, the present position is 000 and TO waypoint is 005. If you press the +/- key, the FROM and TO waypoints change to 005 and 014.

NOTE: *Route navigation has priority over waypoint navigation.*

Connecting routes

A route may only consist of up to ten points. By combining routes, however, you can connect up to ten routes, maximum 100 points.

1) Press [MENU], [5] and [2]. The ROUTE CONNECT display appears.

```
  ROUTE  CONNECT
➡ROUTE  CONNECT  NUMBER(00~10)
     =  ---→---→---→---→---→---→---→---→---→---
  DISABLE  ROUTE  NUMBER  =  --
  ROUTE  CONNECT  NAV  =  FORWARD
                          (1:REVERSE  0:FORWARD)
  ROUTE  CONNECT  NAV  =  OFF(1:ON  0:OFF)
```

Figure 4-11 ROUTE CONNECT display

2) Press [CLR].

3) Enter routes you want to connect, in navigating order.

4) Press [ENT].

5) To disable a route;

(1) Press [▼]. The cursor moves to DISABLE ROUTE NUMBER.

(2) Enter route number you want to disable.

[CLR][ ][ ][ENT]

6) Press [▼].

7) Enter direction in which you want to traverse the route; forward or reverse.

[CLR][ ][ENT]

Enter 0 for forward; 1 for reverse.

8) Start navigation on connected routes.

(1) Press [▼].

(2) Press CLR and 1.

(3) Press ENT. "ON" appears on ROUTE CONNECT NAV line.

Canceling route navigation

1) Press MENU, 5 and 1.

2) Press CLR and ENT.

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MISCELLANEOUS FUNCTIONS

This chapter covers miscellaneous functions. These are

- correcting chart system
- displaying magnetic bearing
- changing units of measurement and display indications
- selecting back-up navigator, and
- entering initial settings.

Selecting Geodetic Chart System

A nautical chart is usually made by either trigonometrical survey or astronomical survey and according to the geodetic chart standards of the country it is used in. For example, the USA uses the system called NAD-83; and Japan, TOKYO. Accordingly when you are getting position fixes by GPS in the USA, the system should be NAD-83 so you don't get a position fix which shows you're somewhere offshore when you're actually moored to a dock.

Standard GPS chart system

While the use of one category of chart systems is fine if you don't do transoceanic voyages, ocean-going vessels may require all categories to get reliable position information. To solve this inconvenience, a standard chart system was adopted by GPS: the WGS-84. The chart default setting is for WGS-84.

Chart systems stored in this unit

Although the WGS-84 system is now widely used other categories of charts still exist.

The GP-500 MARK-2 recognizes most major charts. (The charts this unit recognizes appear on page A-5 to A-8.) Select the chart system used, not the area where the boat is sailing.

Selecting chart system

1) Press [MENU], [9] and [1]. The DATUM SELECT display appears.

```
  D A T U M   S E L E C T
➡D A T U M   S E L E C T      =W G S - 8 4
 V A R   F R O M   W G S - 8 4   0 . 0 0 0 ' S   0 . 0 0 0 ' W

 0 0 1 : W G S - 8 4   0 0 2 : W G S - 7 2     0 0 3 : T O K Y O
 0 0 4 : N A D - 2 7   0 0 5 : E U R O P E A N   0 0 6 : A U S T R A L I A N
 0 0 7 ~ : R E F E R   T O   O P E R A T O R ' S   M A N U A L
```

Figure 5-1 DATUM SELECT display

2) Enter geodetic chart number. The display shows the six major charts of the world. You may select one of these, or any of the charts shown on pages A-5 to A-8.

[CLR] [ ] [ ] [ ] [ENT]

NOTE: *The chart selected here affects GPS position fixes only. It does not affect latitude and longitude position fed from an external navigator.*

Entering Magnetic Variation

The location of the magnetic north pole is different from the geographical north pole. This causes a difference between the true and magnetic north direction. The difference is called magnetic variation, and varies with respect to the observation point on the earth. The GP-500 MARK-2 is preprogrammed with all the earth's magnetic variations. You can enter magnetic variation yourself, or let the GP-500 MARK-2 do it for you.

1) Press [MENU], [9] and [4]. The MAGNETIC CORRECTION display appears.

```
MAGNETIC VARIATION
➡VARIATION      = MANU (1:AUTO 0:MANU)
 VARIATION VAL  =   0.0° E
```

Figure 5-2 MAGNETIC VARIATION display

For automatic magnetic variation;

2) Press [CLR], [1] and [ENT].

The correction value is automatically calculated and displayed at the display bottom next to "MAG."

For manual magnetic variation;

1) Press [CLR], [0] and [ENT].

2) Press [▼].

3) Enter magnetic variation, by consulting a recent nautical chart.

[CLR] [ ] [ ] [ ] . [ ] ([+/-]) [ENT]

NOTE 1: *If you have manually entered magnetic variation, be sure to change it when magnetic variation changes.*

NOTE 2: *To disable manual magnetic bearing display and return to true bearing, enter 000.0. (The indication "MAG" is erased.)*

Changing Units of Measurement and Display Indications

1) Press [MENU], [9] and [5]. The DISPLAY UNIT display appears.

```
          D I S P L A Y   U N I T
➡LAT.LONG RESO  =  0.001  (1:0.01  0:0.001  )
 RNG.BRG CALC   =  GC     (1:RL    0:GC     )
 HEIGHT UNIT    =  METER  (1:METER 0:FEET   )
 RNG・SPD UNIT  =  NM   (1:NM  2:KM  3:SM  )
 BAR GRAPHIC    =  XTE  (1:OFF 2:XTE 3:△C  )
 VTD/BRG/RNG    =  VTD  (1:VTD 2:BRG 3:RNG)
```

Figure 5-3 DISPLAY UNIT display

2) Select resolution level for latitude and longitude display.

[CLR] [ ] [ENT]

Enter 1 for tenths place resolution; 0 for hundredths place resolution.

3) Press [▼].

4) Select method for calculation of range and bearing; great circle or rhumb line.

[CLR] [ ] [ENT]

1 for rhumb line; 0 for great circle

5) Press [▼].

6) Select unit for height.

[CLR] [ ] [ENT]

1 for meters; 0 for feet

7) Press [▼].

8) Select unit for range and speed readouts.

[CLR] [ ] [ENT]

1, nautical mile; 2, kilometer; 3, statute miles

9) Press [▼].

10) Select item to display on bar graph.

[CLR] [ ] [ENT]

1, No display; 2, cross track error; 3, course error

11) Press [▼].

12) Select item to display at top left-hand corner of the "SPD CRS" display. (See page 3-12.)

[CLR] [ ] [ENT]

1, Velocity To Destination; 2, Bearing to TO waypoint; 3, Range to TO waypoint

Selecting Back-up Navigator

The GPS position fix is available almost 24 hours a day from January 1993. Thus the back-up navigator is rarely needed.

However, select the back-up navigator to use when there is no GPS position fixing available.

1) Press **MENU**, **9** and **3**.

2) Press **CLR**, **2** and **ENT**.

For no external navigator, select "2: GPDR."

```
BACK UP NAV SELECT
➡BACK UP NAV          = GPDR
          (1:NONE 2:GPDR 3:NNDR 4:LRN-A
           5:LRN-C 6:OMG 7:DEC 8:II NAV)
 GPS POSN CORRECT = NO   (1:YES 0:NO)
 GPS COR SMOOTHING= 0    (0~9)
 GPS CORRECT VAR  : 0.000' N 0.000' W
```

Figure 5-4 BACK UP NAV SELECT display

If there is no back-up navigator, enter speed and heading information as follows.

3) Press **MENU**, **9** and **2**.

4) Press **CLR**, **0** and **ENT** to select MANUAL (speed input).

```
LOG·GYRO DATA          (▼:GYRO)
➡LOG      = MANUAL  (1:AUTO  0:MANUAL)
 SPD      = 0.0KT
 LOG IN   = TTL     (1:CONTACT 0:TTL )
 LOG PULSE(IN) =  200P/NM (100~500P/NM)
                  (9000~30000P/NM)
 LOG PULSE(OUT)=   0P/NM (  0~500P/NM)
```

Figure 5-5 LOG GYRO DATA display

5) Press **▼**.

6) Enter ship's speed, in three digits.

[CLR] [ ] [ ]. [ ] [ENT].

7) Press [▼] four times.

8) Press [CLR], [0] and [ENT] to select MANUAL (heading input).

```
  LOG • GYRO  DATA                    (▲:LOG    )
➡GYRO     =  MANUAL    (1:AUTO  0:MANUAL)
 HDG      =  000.0°

 SET/DFT  SMOOTHING  =  5  (0~9)
```

Figure 5-6 LOG GYRO DATA display

9) Press [▼].

10) Enter heading.

[CLR] [ ] [ ] [ ]. [ ] [ENT].

NOTE: *Steps 3 through 6 and 7 through 10 are for manual entry of speed and heading, respectively. For automatic entry, in case of speed log and gyrocompass connection, select AUTO on the LOG and GYRO lines of the LOG GYRO DATA display.*

Initial Settings

The INIT DATA (2) display allows you to correct latitude and longitude position, enter smoothing values, and disable unhealthy satellites.

1) Press [MENU], [9] and [0]. The INIT DATA (2) display appears.

```
   I N I T   D A T A ( 2 )                    (▼:NEXT)
➡L/L CORRECTION          =  0.000′ N  0.000′ W
  L/L SMOOTHING          =    0SEC  (00~99)
  S/C SMOOTHING          =    5SEC  (00~99)
  AVE S/C SMOOTHING      =  10MIN  (00~99)
  DISABLED SATS : --  --  --  --  --  --  --  --
  DISABLE SAT      =  --
```

Figure 5-7 INIT DATA (2) display (first page)

2) Enter latitude and longitude corrections.

[CLR] [ ] [ ] [ ] [ ]′ ([+/-])

[ ] [ ] [ ] [ ]′ ([+/-]) [ENT]

You can correct the GPS-obtained position fix. Before entering a correction value here, however, confirm that the geodetic chart system setting agrees with your chart. (See page 5-2.). The correction value is applied to the GPS position fix only; it does not affect the position information fed from a back-up navigator.

3) Press [▼].

4) Enter latitude and longitude smoothing.

[CLR] [ ] [ ] [ENT]

The GPS position fix changes randomly when the DOP or receiving condition is unfavorable. This fluctuation may be stabilized by smoothing the raw GPS position fixes as illustrated in Figure 5-8.

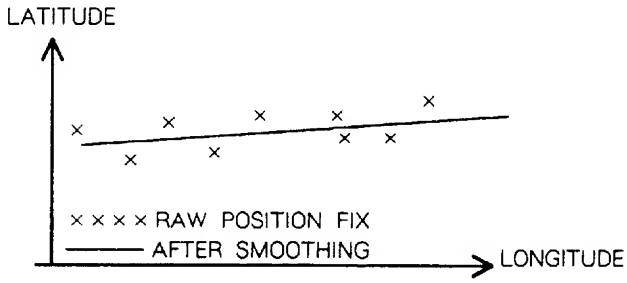


Figure 5-8 Latitude and longitude smoothing

The higher the setting the smoother the raw data. If the setting is too high, however, response to changes in latitude and longitude are delayed. The higher the number, the higher the smoothing. For no smoothing, enter 0. The normal smoothing setting is 0. Increase the setting when the GPS position fixes fluctuate intolerably.

5) Press [▼].

6) Enter speed and course smoothing.

[CLR] [ ] [ENT]

Ship's speed and course are directly measured when receiving GPS satellites. This raw data usually varies randomly depending on receiving condition and other factors. You can smooth this variation as illustrated in Figure 5-9.

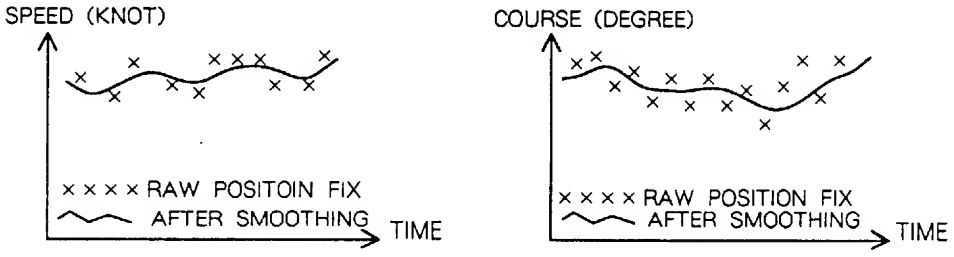


Figure 5-9 Speed and course smoothing

The higher the setting, the smoother the data. If the setting is too high, however, actual speed and caurse are not reflected on the speed and course readings, as illustrated in Figure 5-10. You can enter a smoothing rate from 00 to 99; 0 for no smoothing. "5" seconds is commonly used and provides excellent performance under most conditions.

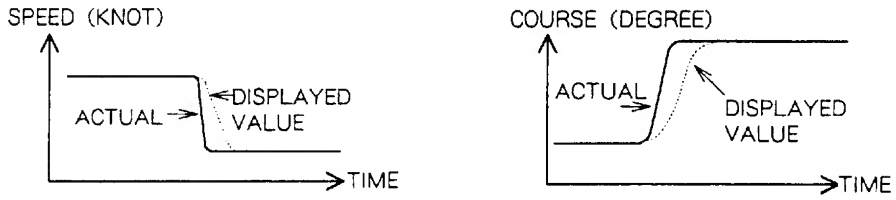


Figure 5-10 What happens when smoothing is set too high

7) Press [▼].

8) Enter average speed and course smoothing.

[CLR][ ][ ][ENT]

The average speed and course are indicated at the SPD CRS display. The average speed and course smoothing setting affects calculation of time-to-go and estimated time of arrival. The default setting is 1 minutes and it provides excellent performance under most conditions.

9) Press [▼].

10) You can manually disable unhealthy satellites to prevent use of them in GPS position fixing.

[CLR][ ][ ][ENT]

Every satellite broadcasts the abnormal satellites in its almanac. When the GP-500 MARK-2 receives an almanac, it automatically eliminates abnormal satellites from the GPS receiving schedule. When the satellite is once again "on-line," this unit includes it in the receiving schedule. Thus you normally are not required to manually disable an abnormal satellite.

Abnormal satellites appearing on the position fixing schedule are automatically deselected satellites. The disabled satellites shown on the INIT DATA (2) display are manually deselected satellites.

11) Press [▼].

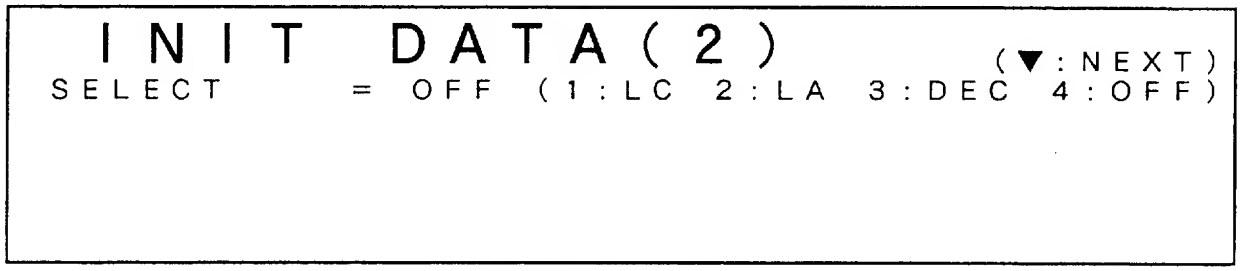


Figure 5-11 INIT DATA (2) display (second page)

12) You may input (and display) Loran A or C TDs or Decca LOPs.

CLR ENT

Select the position information you want to display. Enter 1, Loran C TDs; 2, Loran A TDs; 3, Decca LOPs; or 4, display latitude and longitude only.

13) Press ▼.

- Loran C TDs

For your reference, Loran C chains appear on page A-9.

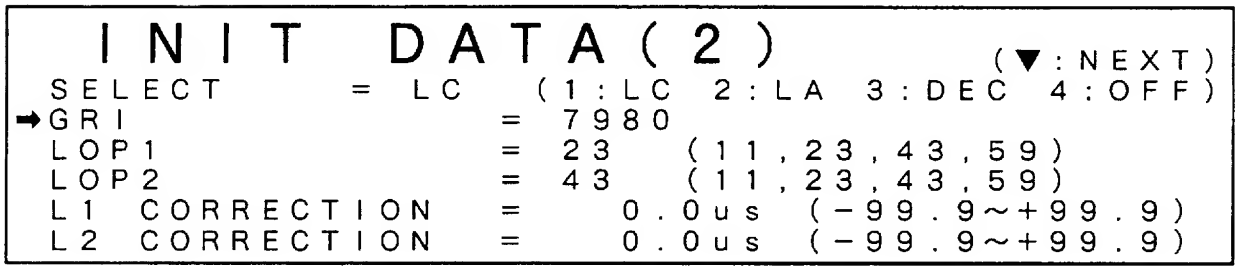


Figure 5-12 INIT DATA (2) display

(1) Enter GRI.

CLR □□□□ ENT

(2) Press ▼.

(3) Enter slave code no. 1.

CLR □□ ENT

(4) Press ▼.

(5) Enter slave code no. 2.

CLR □□ ENT

(6) Press ▼.

- Loran A TDs

For your reference, Loran A chains appear on page A-10.

```
  I N I T   D A T A ( 2 )                    ( ▼ : N E X T )
  S E L E C T      =  L A    ( 1 : L C   2 : L A   3 : D E C   4 : O F F )

➡ L O P 1                    =  1 L 5          ( 1 : S   2 : L   3 : H )
  L O P 2                    =  1 L 6          ( 1 : S   2 : L   3 : H )
  L 1   C O R R E C T I O N  =     0 . 0 u s    ( - 9 9 . 9 ~ + 9 9 . 9 )
  L 2   C O R R E C T I O N  =     0 . 0 u s    ( - 9 9 . 9 ~ + 9 9 . 9 )
```

Figure 5-13 INIT DATA (2) display

(1) Enter slave code no. 1.

CLR □□□ ENT

Use keys 1, 2 and 3 to enter S, L and H, respectively.

(2) Press ▼.

(3) Enter slave code no. 2.

CLR □□□ ENT

(4) Press ▼.

● Decca LOPs

Decca chains appear on page A-11.

```
  I N I T   D A T A ( 2 )                    (▼:NEXT)
  SELECT        = DEC  (1:LC 2:LA 3:DEC 4:OFF)
  CHAIN NO      =  24   (01~48)
➡LOP1           =  GREEN  (1:R 2:G 3:P)
  LOP2          =  PURPLE (1:R 2:G 3:P)
  L1 CORRECTION = -0.00LANE (-9.99~+9.99)
  L2 CORRECTION = -0.00LANE (-9.99~+9.99)
```

Figure 5-14 INIT DATA (2) display

(1) Enter chain number.

[CLR] [ ] [ ] [ENT]

(2) Press [▼].

(3) Enter slave code no. 1.

[CLR] [ ] [ENT]

Use keys [1], [2] and [3] to enter red, green and purple stations, respectively.

(4) Press [▼].

(5) Enter slave code no. 2

(6) Press [▼].

Loran C

```
➡L1 CORRECTION =    0.0us  (-99.9~+99.9)
  L2 CORRECTION -   0.0us  (-99.9~+99.9)
```

Loran A

```
➡L1 CORRECTION =    0.0us  (-99.9~+99.9)
  L2 CORRECTION =   0.0us  (-99.9~+99.9)
```

Decca

```
➡L1 CORRECTION =  0.00LANE  (-9.99~+9.99)
  L2 CORRECTION =  0.00LANE  (-9.99~+9.99)
```

14) Enter correction for LOP1.

[CLR] [ ] [ ] [ ] [+/-] [ENT]

Variation in signal propagation delay can cause constant errors in the computed LOP (or TD). You can enter manual LOP corrections to further refine the LOP coordinates on a particular chart.

15) Press [▼].

16) Enter manual LOP or TD correction for LOP2.

[CLR] [ ] [ ] [ ] [+/-] [ENT]

17) Press [▼].

```
  I N I T   D A T A ( 2 )                    (▼:NEXT)
 BACKUPNAV BUZZER      = OFF(1:ON 0:OFF)
 FORCED SAT      :--   -- -- -- -- -- -- --
➡FORCED SAT      = --
 1S CLK CORRECTION =    0us (-999~+999)
```

Figure 5-15 INIT DATA (2) (third page)

18) Select whether to generate the buzzer (three beeps) when GPS position fixing becomes available or unavailable. Enter 1 to enable the buzzer; 0 for no buzzer.

19) Press [▼] twice.

20)Enter clock correction in microseconds.

The GP-500 MARK-2 employs an extremely accurate clock which generates a one-second interval pulsed signal. It is synchronized to the GPS satellites atomic clock, but if the antenna cable is very long accurate synchronization may not be possible. In this case enter correction in microseconds.

Differential GPS

Refer to page 8-30 for DGPS Beacon Receiver and connect the cable to "Data in/out" connector. Initialize GP-500 Mark-2 according to the specification of the DGPS Beacon Receiver.

Initial settings

1) Press [MENU], [8] and [0]. The INITIAL DATA (DGPS) display appears.

```
   I N I T I A L   D A T A  ( D G P S ) ( ▼ : N E X T )
➡D  GPS  MODE     =  ON     ( 1 : ON      0 : OFF )
  RTCM  VERSION=   2 . 1    ( 1 : 1 . 0   0 : 2 . 1 )
  BYTE  FORMAT  =  8 – 6    ( 1 : 8 – 8   0 : 8 – 6 )
  FIRST  BIT    =  LSB      ( 1 : LSB     0 : MSB )
  PARITY  BIT   =  NONE     ( 1 : NONE  2 : ODD  3 : EVEN )
  STOP  BIT     =  1        ( 1 : 2     0 : 1 )
```

Figure 5-16 INITIAL DATA (DGPS)

2) Press [CLR], [1] and [ENT] to turn on DGPS function.

3) Press [▼].

4) Select RTCM VERSION.

[CLR] [ ] [ENT]

Enter for version 2.1.
(Only "version 2.1" is available.)

5) Press [▼].

6) Select BYTE FORMAT.

[CLR] [ ] [ENT]

Enter 1 for 8-6; 0 for 8-8.

7) Press [▼].

8) Select what comes for FIRST BIT.

[CLR] [ ] [ENT]

Enter 1 for LSB; 0 for MSB.

9) Press [▼].

10) Select type of PARITY BIT.

[CLR] [ ] [ENT]

Enter 0 for no parity bit.
(Only "no parity bit" is available.)

11) Press [▼].

12) Select the number of STOP BIT.

[CLR] [ ] [ENT]

Enter 0 for one stop bits.
(Only "one stop bit" is available.)

13) Press [▼].

14) Select the number of BIT RATE.

[CLR] [ ] [ENT]

Enter 0 for 8 bits.
(Only "8 bits" is available.)

15) Press [▼].

16) Enter data communication speed (BAUD RATE) in four digits.

[CLR] [4] [8] [0] [0] [ENT]

(Only "4800 bps" is available.)

When you are in a DGPS service area and in the DGPS mode, "DGPS" appears on the display. This means the position shown is corrected by DGPS.

When you go out of DGPS service area, "DGPS" disappears.

Data receiving status

1) Press MENU, 8 and 1. The DGPS STATUS MONITOR display appears. This display shows the condition of the data reception.

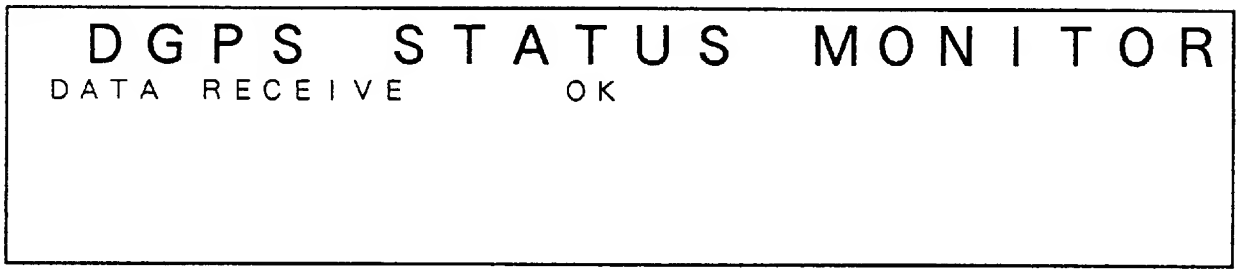


Figure 5-17 DGPS STATUS MONITOR

When the data reception is good, GP-500 MARK-2 starts DGPS operation.
"DGPS" appears as position-fixing system in use at the top left corner of the screen.

Default Settings

When the internal memory is cleared default settings are automatically restored. The default settings are as follows.

[MENU]

- **[0]: INITIAL DATA (1)**
  - Mon/Day/Year = * */* */* *
  - Time = * *:* *′ * *″
  - Local Zone Time = + 0 0H0 0M

  } UTC is set.

  - Latitude = 38° 0 0.0 0′ N
  - Longitude = 123° 0 0.0 0′ W

  } San Francisco, USA

  - Position Mode = 2 D
  - Antenna Height = 5 M
  - MASK ELEVATION = 5°
- **[9]: SYSTEM DATA MENU**
  - [0]: INITIAL DATA (2)
    - L/L Correction = 0.0 0 0′ N 0.0 0 0′ W
    - L/L Smoothing = 0
    - S/C Smoothing = 5
    - AVE S/C Smoothing = 1
    - DISABLED SATS = None
    - SELECT = OFF
    - Backup NAV Buzzer = OFF
    - Forced Sats = None
    - 1S CLK Correction = None
  - [1]: DATUM SELECT
    - Datum Select = WGS-84
  - [2]: LOG•GYRO DATA
    - Log Mode = MANUAL
    - Speed = 0.0
    - Log In = CONTACT
    - Log Pulse (In) = 2 0 0 P/NM
    - Log Pulse (Out) = 0 P/NM
    - Gyro Mode = MANUAL
    - Heading = 0.0
    - Set/Drift Smoothing = 5

- [3]: BACK UP NAVAID SELECT
  - Back-up Navaid = None
  - GPS Position Correction = NO
  - Smoothing = 9
  - GPS Correction = None
- [4]: MAGNETIC VARIATION
  - Correction = MANUAL
  - Correction Variation = 0.0° E
- [5]: DISPLAY UNIT
  - Lat/Long Resolution = 0.0 0 1
  - Range Bearing Calculation = GREAT CIRCLE
  - Height Unit = Meter
  - Range/Speed Unit = NM
  - Bar Graphic = XTE
  - VTD/BRG/RNG = VTD
- [9]: I/O DATA FORMAT
  - [0]: DATA IN CONNECTOR
    - Format = NMEA 0183
  - [1]: DATA OUT CONNECTOR
    - Format = CIF
      - Out Data = L/L: 01, R/B: 60, S/C: 01, HGT: 01
      - Data Change = no
      - GPS Data Out =ON
      - GPS Error Code Out = ON
    - Format = IEC 1162
      - Interval = AAM: 04, BOD: 04, BWC: 04, GGA: 10, GLL: 01, VDR: 10, VTG: 01, WPL: 60, XTE: 04, ZDA: 01, All others: 00
  - [2]: DATA IN/OUT CONNECTOR
    - Format = RS232C
    - Interval = AAM: 04, BOD: 04, BWC: 04 GGA: 10, GLL: 01, VDR: 10, VTG: 01, WPL: 60 XTE: 04, ZDA: 01, All others: 00
  - [3]: AUTOPILOT DATA
    - Format = IEC 1162
      - Interval = AAM: 04, BOD: 04, BWC: 04, VTG: 04, XTE: 04

ALARMS

This chapter provides the information necessary for setting the alarms and the stopwatch. There are nine conditions which can generate both audible and visual alarms in the GP-500 MARK-2. These are:

- Timer
- Stopwatch
- Wake-up
- Arrival alarm
- Anchor watch alarm
- Cross track error (XTE) alarm
- Border alarm
- Ship's speed alarm, and
- Trip alarm.

CAUTION: *The alarms are useful for alerting you to possibly dangerous situations. However, the captain is always responsible for the safe operation of his ship. FURUNO Electric Company will assume no responsibility for any damages associated with the use of the alarms.*

Timer, Stopwatch and Wake-up

Description

Timer

The audible alarm sounds when the preset time has elapsed.

Stopwatch

The stopwatch counts elapsed time.

Wake-up

The audible alarm sounds at the predetermined time.

Selecting timer or stopwatch

1) Press [MENU] and [2]. The TIMER SET display appears.

```
   T I M E R   S E T
➡MODE  SELECT   =  T I M E R   ( 1 : T I M E R   0 : W A T C H )
  H O U R       =  0 2 H 0 0 M 0 0 S
  R E P E A T   =  O F F   ( 1 : O N   0 : O F F )
  B U Z Z E R   =  O N     ( 1 : O N   0 : O F F )
W A K E  U P  T I M E  =  0 6 H 2 5 M
  B U Z Z E R   =  O N     ( 1 : O N   0 : O F F )
```

Figure 6-1 TIMER SET display

2) Select timer or stopwatch. 1, timer; 0, stopwatch.

[CLR] [ ] [ENT]

3) Press [▼].

If you selected the timer;

(1) Enter the time interval you want to get the alarm.

[CLR] [ ][ ][ ][ ][ ][ ] [ENT]
hr. min. sec.

(2) Press [▼].

(3) Select 1 if you want repeated count down sequence with audible alarm at every terminal count. Select 0 for one-time count down.

(4) Press [▼].

(5) Select if you want the audible alarm. 1 for yes; 0 for no.

[CLR] [ ] [ENT]

(6) Press [▼].

If you selected the stopwatch;

Note that the hour, repeat and buzzer indications do not appear with the stopwatch.

(1) Press [▼].

4) Set wake-up timer.

(1) Set time desired.

[CLR] [ ][ ][ ][ ] [ENT]
hr. min.
(00 to 23)

(2) Press [▼].

(3) Press [CLR], [ ] and [ENT].

Select whether you want the audible alarm or not. 1, ON; 2, OFF

Starting the stopwatch

1) Press [MENU] and [1]. The S.(top) WATCH display appears.

```
S. WATCH : 00H00M00S

(▲:START ▼:STOP +/−:LAP)
```

Figure 6-2 S. WATCH display

2) Press [▲] to start the stop watch.

3) If you need lap time, press [+/-]. The reading freezes but the stopwatch continues to count up.

4) To return to stopwatch reading, press [+/-] again.

5) Press [▼] to stop the stopwatch.

NOTE: *The stopwatch counts up to 99 hours, 59 minutes and 59 seconds, whereupon it resets to zero and resumes counting up.*

Starting the timer

1) Press [MENU] and [1]. The TIMER display appears.

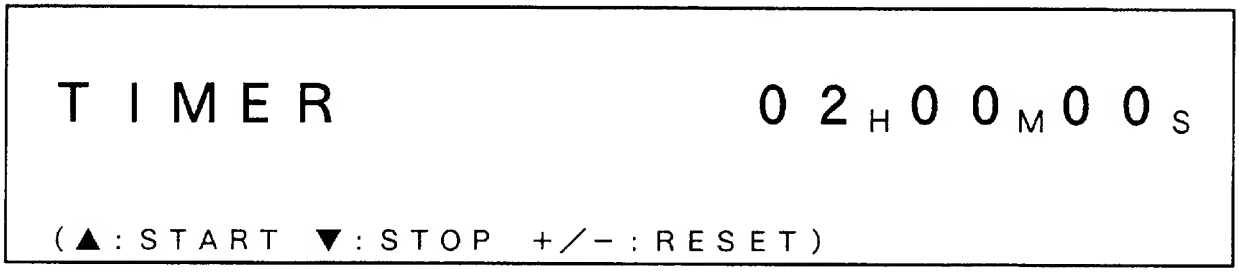


Figure 6-3 TIMER display

2) Press [▲] to start counting.

3) Press [▼] to stop counting.

4) Press [▲] to resume counting.

When the timer counts to 00 hours, 00 minutes, and 00 seconds, three beeps sound if REPEAT ON is selected, or the buzzer sounds continously if REPEAT OFF is selected.

NOTE: *You can press [+/-] at any time to return to the preset time. Then, to restart the timer, press [▲].*

Anchor Watch, Arrival, Cross Track Error, Border, Speed, & Trip Alarms

Alarm description

Anchor watch alarm

The anchor watch alarm sounds to warn you that your vessel has moved outside the anchor watch zone.

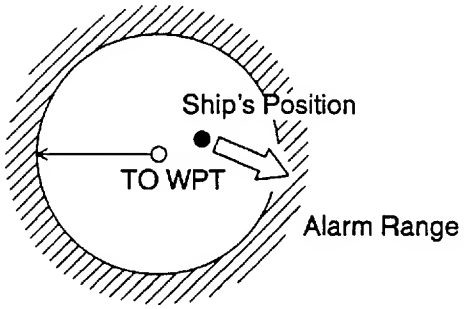


Figure 6-4 How the anchor watch alarm works

Arrival alarm

The arrival alarm warns you your vessel is approaching a destination waypoint. The area that defines an arrival zone is that of a circle which you approach from outside the circle. The alarm will be released if your vessel enters into the circle.

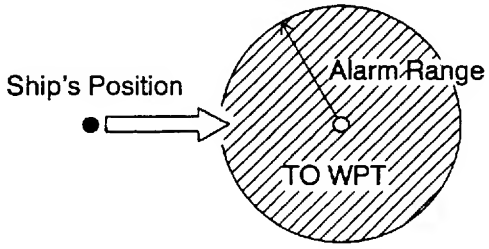


Figure 6-5 How the arrival alarm works

Cross track error alarm

The cross track error alarm alerts you when your vessel is off its intended course. You may preset the alarm limit from 0.01 nautical miles to a maximum lane width of 99.99 nautical miles. The alarm will be released if your vessel goes out of the lane limits.

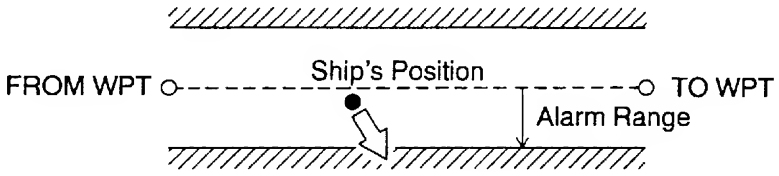


Figure 6-6 How the cross track error alarm works

Border alarm

The border alarm defines an area, comprised of two waypoints, starting waypoint and destination waypoint, which you do not want to cross. The alarm will sound when your vessel crosses the area defined by the two waypoints.

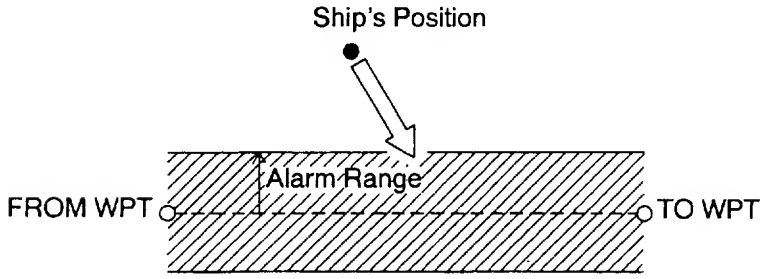


Figure 6-7 How the border alarm works

Ship's speed alarm

The ship's speed alarm sounds when ship's speed is higher or lower than the preset speed alarm setting.

Trip alarm

The trip alarm sounds when the trip distance exceeds the trip alarm setting.

How to set the alarms

1) Press **MENU**, **6** and **0**.

2) Set anchor watch alarm or arrival alarm.

(1) Enter alarm range and select alarm.

CLR □.□□ (**+/-**) **ENT**

Press [+/-] to select alarm desired; arrival or anchor watch.

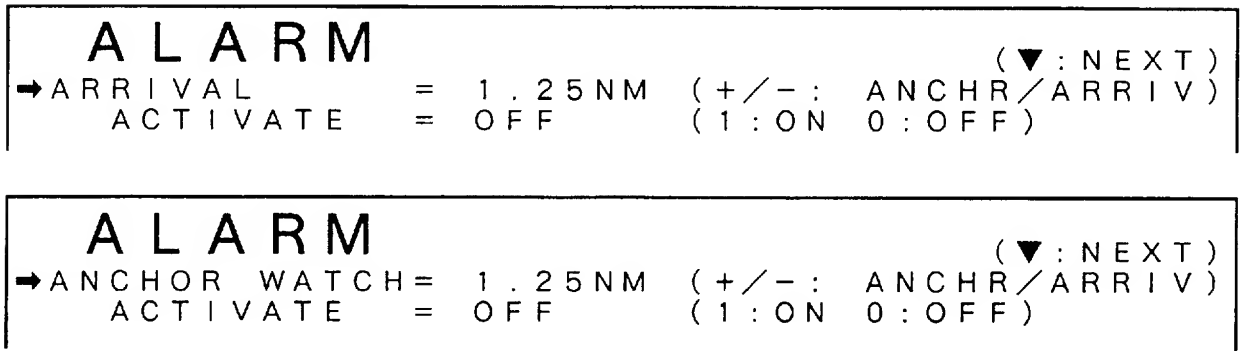


Figure 6-8 Displays for arrival and anchor watch alarms

(2) Press the [▼].

(3) Turn the alarm on or off.

[CLR] [ ] [ENT]

1, ON; 0, OFF

(4) Press [▼].

3) Set XTE (cross track error) alarm or border alarm.

(1) Enter alarm range and select alarm.

[CLR] [ ]. [ ][ ] ([+/-]) [ENT]

Press [+/-] to select alarm desired; XTE or border.

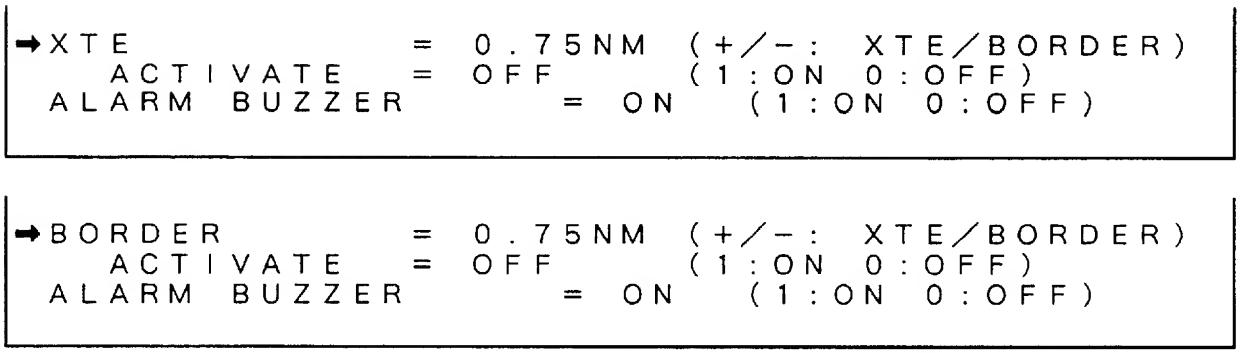


Figure 6-9 Displays for XTE and border alarms

(2) Press the [▼].

(3) Turn the alarm on or off.

CLR [ ] ENT

1, ON; 2, OFF

(4) Press ▼.

4) Select whether you want the audible alarm or not.

CLR [ ] ENT

1, ON; 2, OFF

If you have enabled the audible alarm it will sound when an alarm setting is exceeded.

5) Press ▼.

```
ALARM                                          (▼:NEXT)
➡MAX SPEED      =  999KT    (000~999)
 MIN SPEED      =  0KT      (000~999)
   MONITOR      =  OFF      (1:ON 0:OFF)
 TRIP RANGE     =  0.0NM    (0000.0~9999.9)
   MONITOR      =  OFF      (1:ON 0:OFF)
 NAV ALARM BUZZER = ON(1:ON 0:OFF)
```

Figure 6-10 ALARM display

6) Set ship's speed alarm.

(1) Enter maximum ship's speed.

CLR [ ][ ][ ] ENT

(2) Press ▼.

(3) Enter minimum ship's speed.

CLR [ ][ ][ ] ENT

(4) Press ▼.

(5) Turn the monitor (visual alarm) on or off.

CLR [ ] ENT

1, ON; 2, OFF

7) Set trip alarm.

(1) Enter alarm range.

CLR □□□□.□ ENT

To reset distance run to 0, enter 0000.0. (See page 3-16.)

(2) Press the ▼.

(3) Turn the monitor (visual alarm) on or off.

CLR □ ENT

1, ON; 0, OFF

(4) Press ▼.

8) Select whether you want the audible alarm or not. This is same as step 4). Enable or disable the audible alarm at step 4 or step 8.

When the audible alarm sounds, you can silence it by pressing the CLR key.

Alarm Display

When an alarm setting is exceeded or internal fault is detected the unit releases both audible (if enabled) and visual alarms. To know which alarm is sounding look at the alarm/error indication at the bottom right-hand corner of the display.

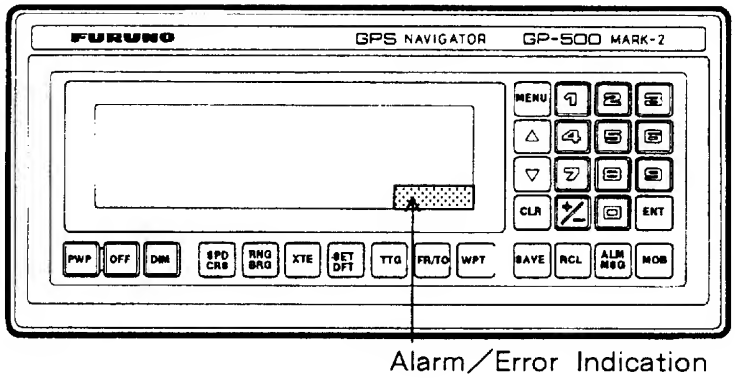


Figure 6-11 Location of alarm/error indication

The alarm/error indication appears on the speed/course, range/bearing, XTE, set/drift, and time-to-go display screens.

NOTE 1: *"PF" appears on the display when turning on the power. This does not indicate equipment trouble. It will disappear when you press a key.*

NOTE 2: *You can silence the audible alarm with the* **CLR** *key. The visual alarm remains on the display until the cause of the alarm is removed.*

NOTE 3: *When two or more alarms are exceeded their indications appear alternately on the display.*

Alarm indications

The following indications appear and blink every 2 seconds to alert you to alarm violation.

HOUR ····· Timer reached zero
TIME ····· Wake-up alarm
ANCH ····· Anchor watch alarm
ARV ····· Arrival alarm
XTE ····· Cross track error alarm
BDR ····· Border alarm
SPD ····· Ship's speed alarm
TRIP ····· Trip alarm

Error indications

The following indications appear and blink every 1.5 seconds to alert you to equipment error.

SERR: Self test error. The GP-500 MARK-2 tests itself periodically for proper operation. If it detects error, "SERR" appears. To identify the faulty component, conduct the self test described on page 7-6.

BERR: The memory contents are kept alive by a lithium battery when the power is off. The estimated life of the battery is four years. "BERR" appears when battery voltage is low. In this case you can set two dry cells (UM4) in the battery case on the rear panel, or replace the lithium battery. The life of the dry cell is about one year. You may leave the expired lithium battery inside the unit. (There is no fear of leakage for more than ten years.)

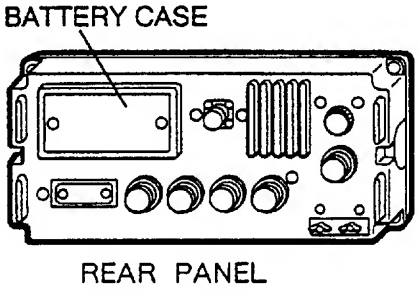


Figure 6-12 GP-500 MARK-2, rear view

NOTE 1: *The dry cell batteries are not consumed while the power is on.*

NOTE 2: *Memory contents are preserved for about 12 hours with no back-up dry cells.*

DERR: Data error. This means memory contents may have been corrupted by short circuit, noise, large fluctuation of supply voltage or other factors. Press the **ALM MSG** key. See page 6-15.

RERR: No data fed from back-up navigator for 30 seconds. Check navigator (gyrocompass, loran, etc.) and connection cable between GP-500 MARK-2 and navigator.

PF: Power failure. It appears momentarily when you turn on the power. If it appears any other time, check the ship's power supply.

D.ER: The condition of the DGPS data reception is no good.

Displaying Full Alarm/Error Indication

If several alarms or errors occur together, it may be difficult to distinguish which alarm is sounding, because alarm/error indications appear alternately. You can display on one screen which alarms are sounding.

Press the **ALM MSG** key. One of the following displays appears. The date and time when the alarm condition began appear on the display.

No alarm

```
NO  ALARM

JAN 15 '93 13:25 56 U
```

Alarm indications

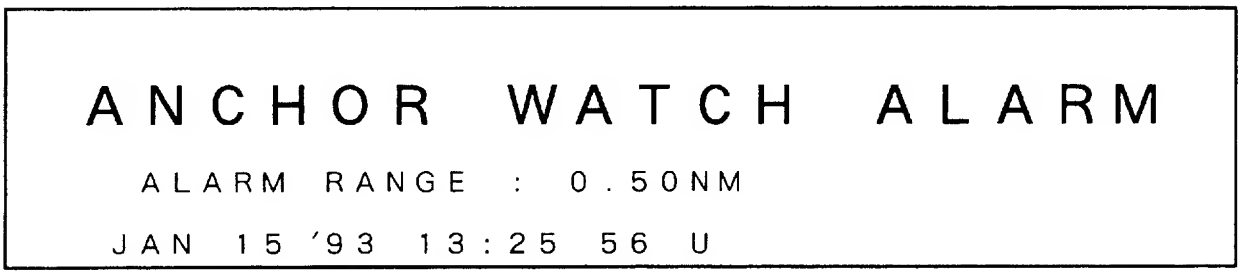
Timer

```
ELAPSED HOUR ALARM
  SET TIME    : 01H15M00S
JAN 15 '93 13:25 56 U
```

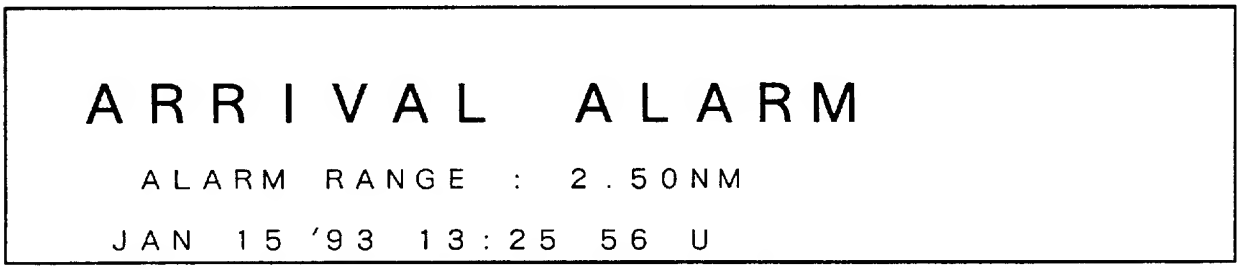
Wake-up alarm

```
WAKE UP TIME ALARM
  WAKE UP TIME: 16H45M
JAN 15 '93 13:25 56 U
```

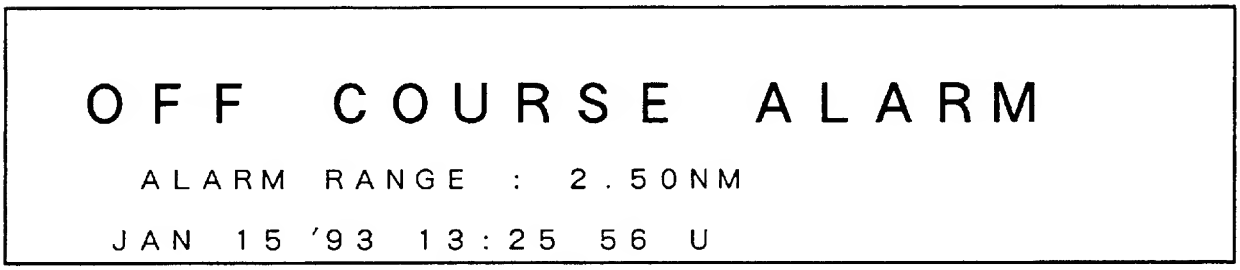
Anchor watch alarm



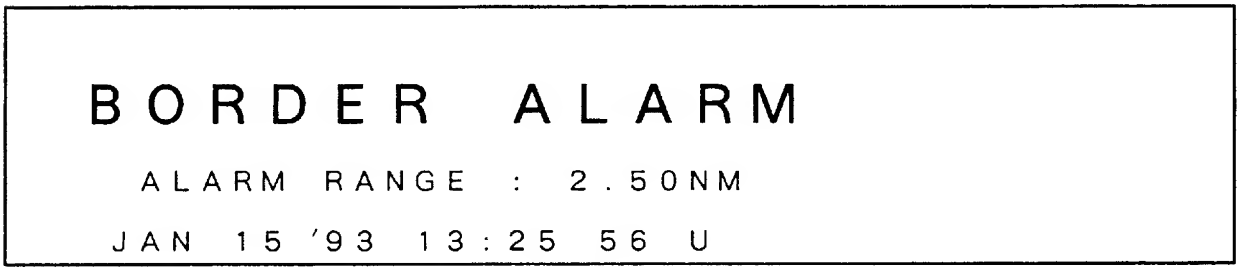
Arrival alarm



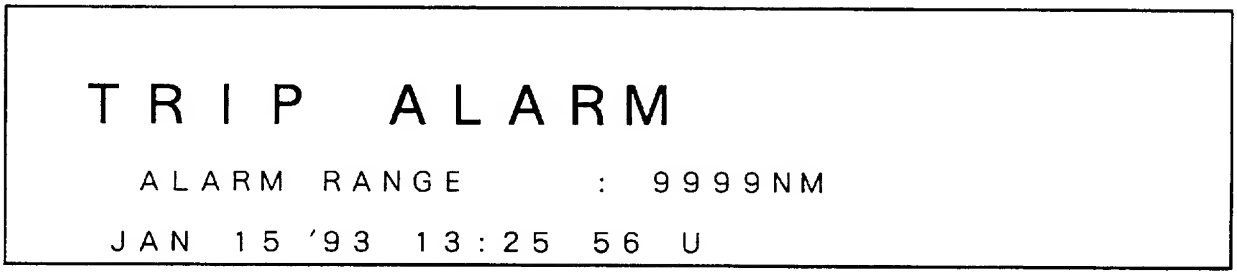
XTE alarm



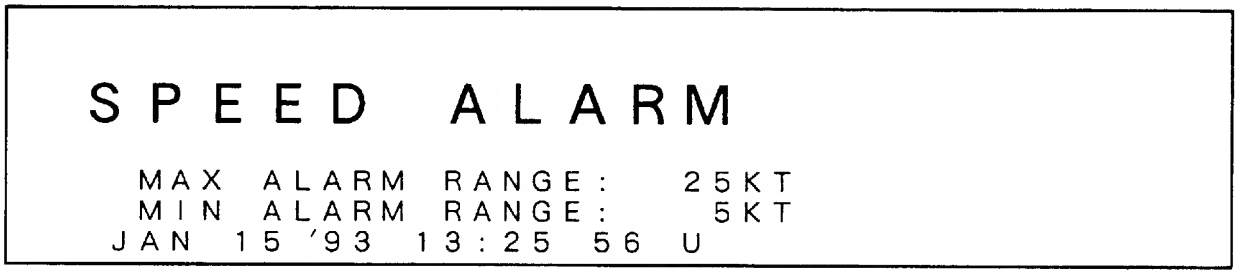
Border alarm



Trip alarm

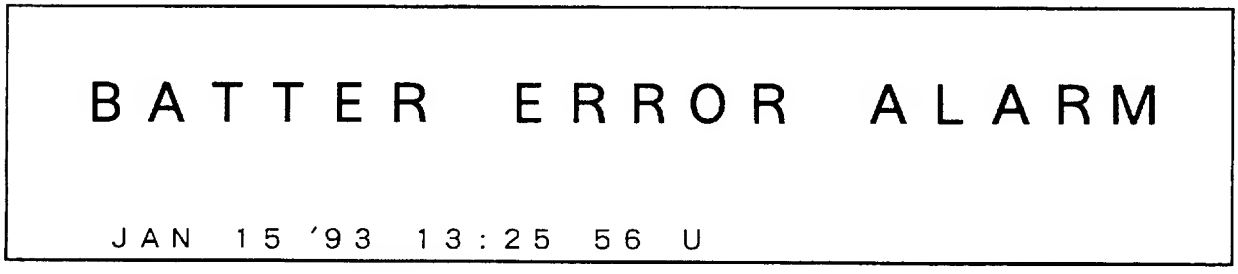


Ship's speed alarm

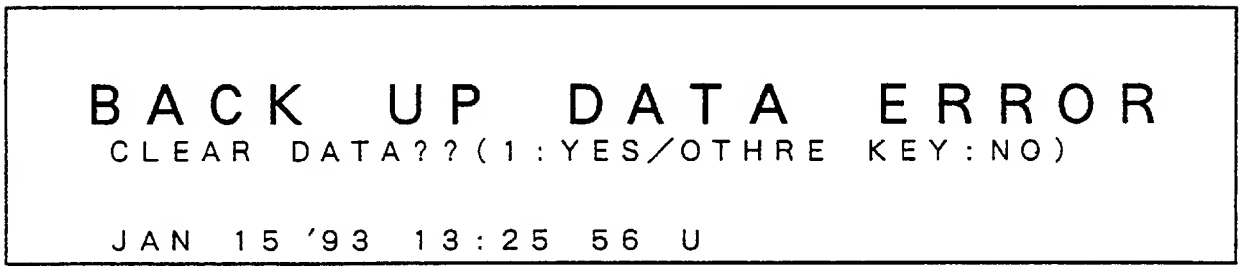


System alarm SERR

BERR



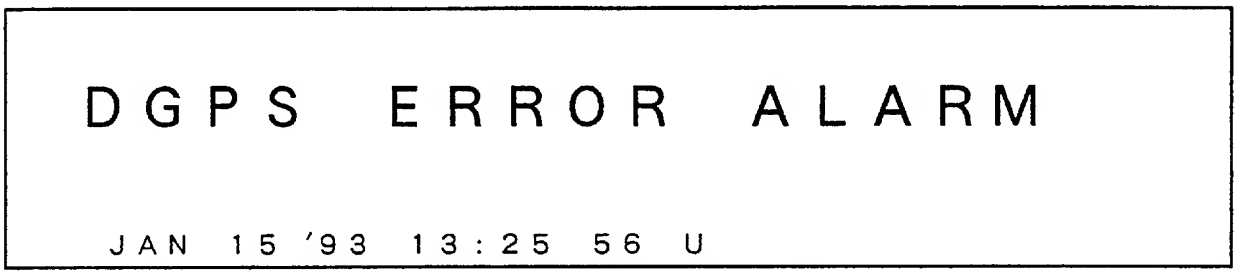
DERR



- This message also appears when error is detected at the power-on self test.
- When this display appears clear the memory by pressing [1] and [ENT]. (If you want to record important waypoints in a log first press any key to escape from the error display. Go to the waypoint display and record waypoints into a log, and then press the [ALM MSG] key again.) All memories are cleared and default settings are restored.

RERR

D. ER



If several alarms or errors exist, "CONTINUE" appears at the bottom right-hand corner of the display. To display which alarms are sounding, press **ALM MSG** continuously.

TROUBLESHOOTING

This chapter contains troubleshooting procedures. Whenever you suspect the unit is not functioning properly follow the troubleshooting procedure to try to restore normal operation.

⚠ WARNING

Do not open the cover of the equipment.

This equipment uses high voltage electricity which can shock, burn or cause death. Only qualified personnel should work inside the equipment.

Troubleshooting

Cannot receive satellite nor fix position

(1) Check for disconnected antenna cable. Look for water leakage near the connector.

(2) Position displayed is more than 10 degrees in error. If so, enter estimated position (within 10 degrees), referring to page 2-8.

(3) Conduct the self test to identify faulty component, referring to page 7-6.

(4) Display cold start information. (See page 7-11). If the almanac is more than one-year old, conduct the cold start.

(5) Display satellite schedule information (page 7-5). If GPS satellite availability on your vessel is less than that on other GPS receiver-equipped vessels the almanac inside the GP-500 MARK-2 may be too old. Conduct the cold start to receive the almanac.

Position fixing period shorter than that on other vessels

(1) Abnormal satellite selected as "healthy" satellite. See page 5-15.

(2) Object (mast, etc.) within line of sight of GPS antenna. An object near the antenna may interfere with reception of the satellite signal.

Set, drift display error

Current speed and direction are calculated as the difference.

Set, drift display error

Current speed and direction are calculated as the difference between speed and speed log and course and gyrocompass, respectively.

(1) Check speed log and gyrocompass for proper operation.

(2) Check speed and course readings for accuracy. Speed and course will vary randomly by slow ship's speed, rolling, pitching, etc. (Ship's vibration is also measured as speed.) Thus current speed and direction will vary according to those factors.

Position error

Check for correction selection of geodetic chart.

Satellite Receiving Condition (SV Display)

Press **MENU**, 9 and 7. The SV (Space Vehicle) CONDITION display appears. This display shows the condition of the satellites currently within line-of-sight.

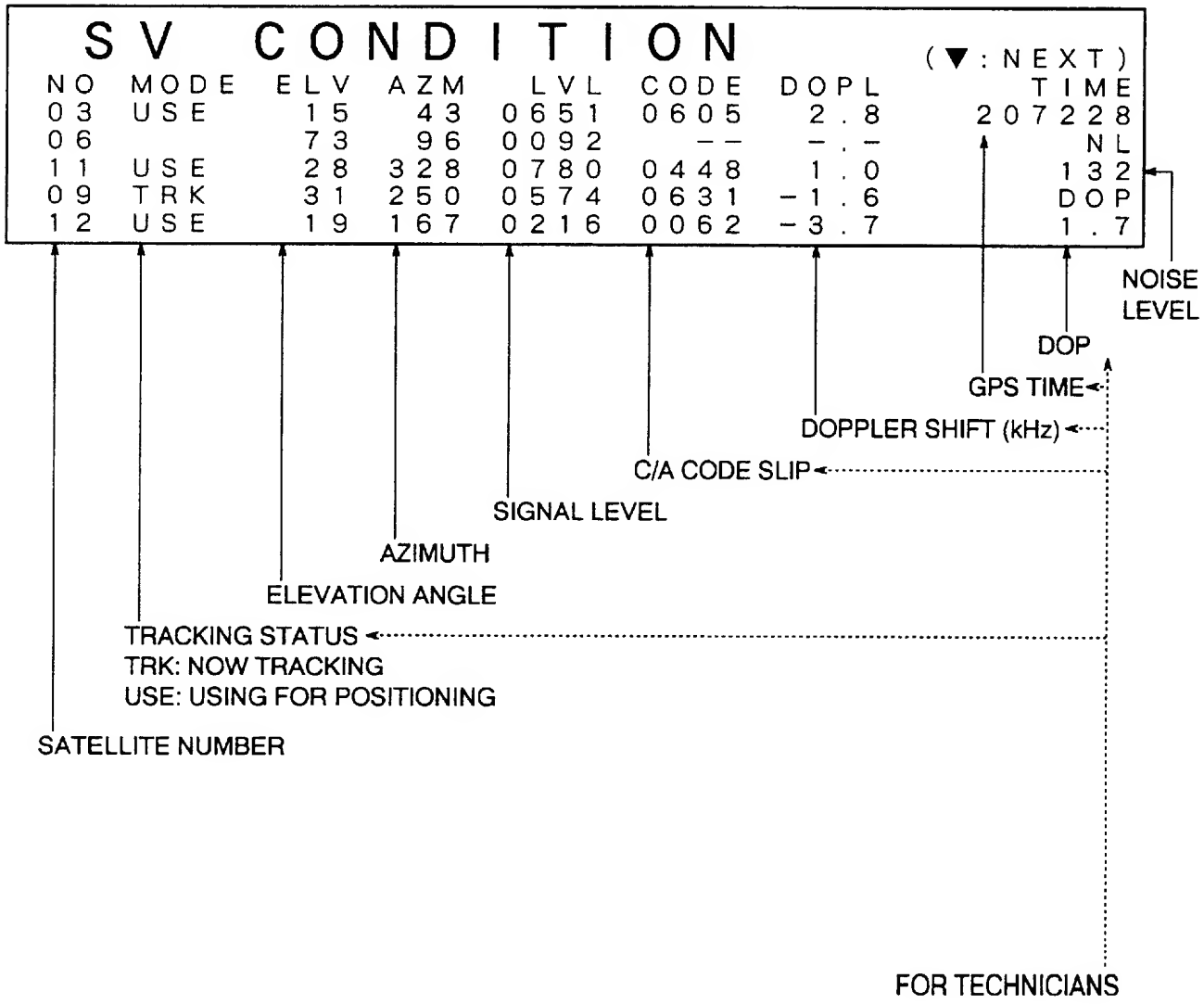
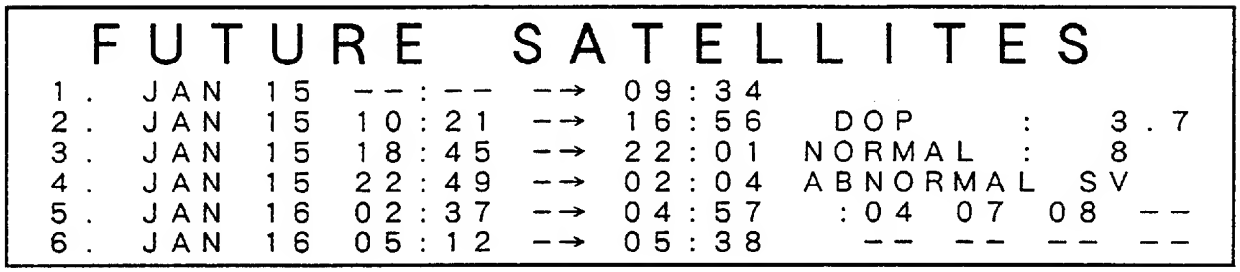


Figure 7-1 Typical SV CONDITION display

Future Satellites Display

Press **MENU** and **7**.



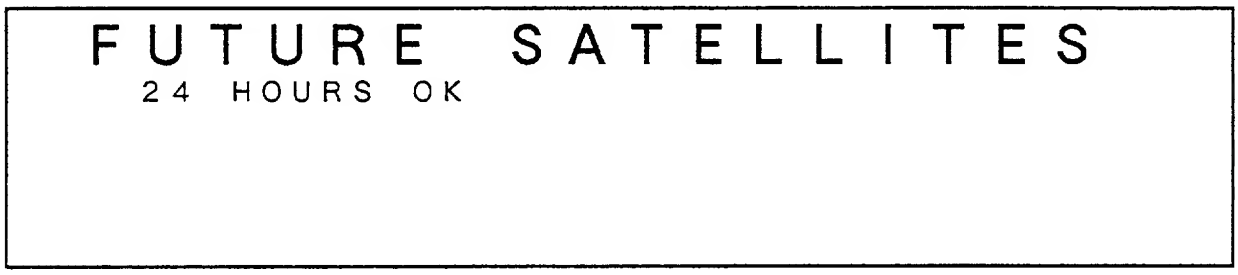


Figure 7-2 Typical FUTURE SATELLITES display

"---:---" means GPS position fix is available at present time. Current DOP also is shown.

NOTE 1: *Prediction based on almanac.*

NOTE 2: *Up to six periods within 24 hours are shown.*

NOTE 3: *The presentation is updated during GPS position fixing. If latitude and longitude are entered during period of no GPS position fixing the presentation is updated every three to four minutes.*

Testing the Unit for Proper Operation

The GP-500 MARK-2 contains various testing facilities which can be conducted by the user to check it for proper operation.

Self test

This function continuously tests the unit for proper operation. It is different from the power-on self test. While the test is being conducted GPS position fixing is not available.

1) Press [MENU], [9], [8] and [0]. Self test results appear on the SELF TEST display.

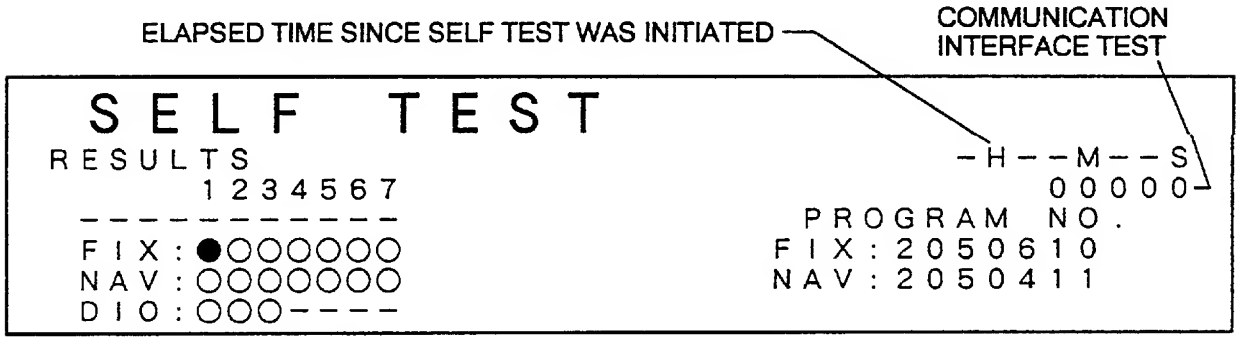
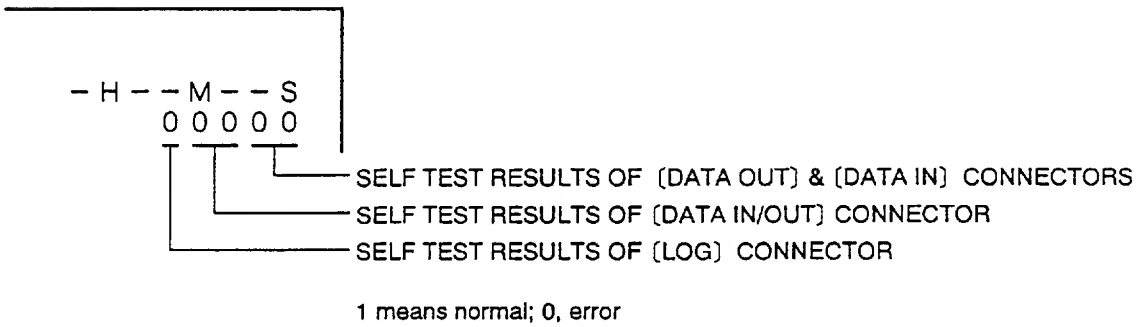


Figure 7-3 SELF TEST display

GPS (FIX), NAV and DIO Boards are tested. A filled circle (●) indicates board error. The test displays ROM program version numbers.

2) To escape from the self test, turn off the power by pressing [PWR] and [OFF] simultaneously.

Communication interface test



This test requires connection of Rx input with Tx inputs by jumper wires as shown in Figure 7-4. In this coupling the GP-500 MARK-2 transmits and receives a test data. If the received data matches the transmitted data, "1" appears on the display. If there is no jumper connected or if external equipment is connected "0" appears.

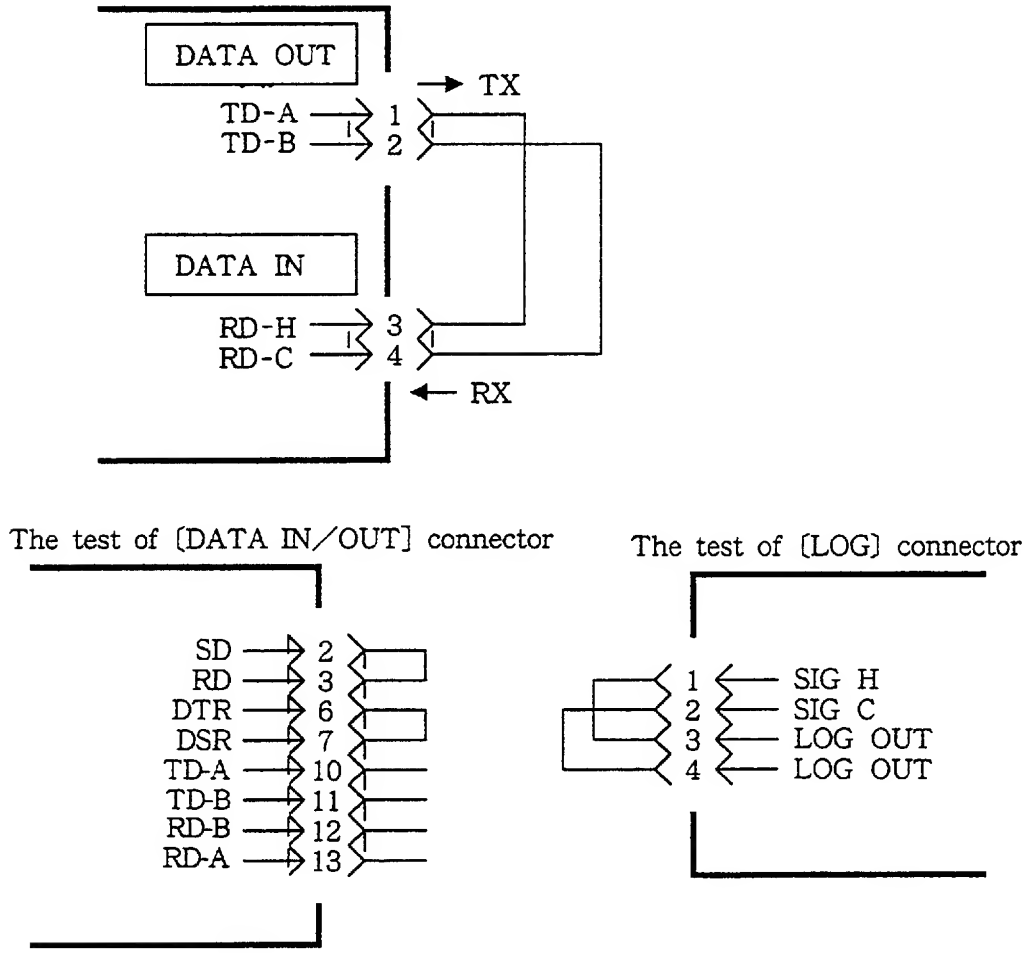


Figure 7-4 Jumper connection for communication test

Keyboard test This test checks each key for proper operation.

1) Press MENU, 9, 8 and 1.

2) Press each key one by one, except PWR and OFF keys. The associated indication fills the display if the key is functioning properly. Figure 7-5a shows key and associated indication.

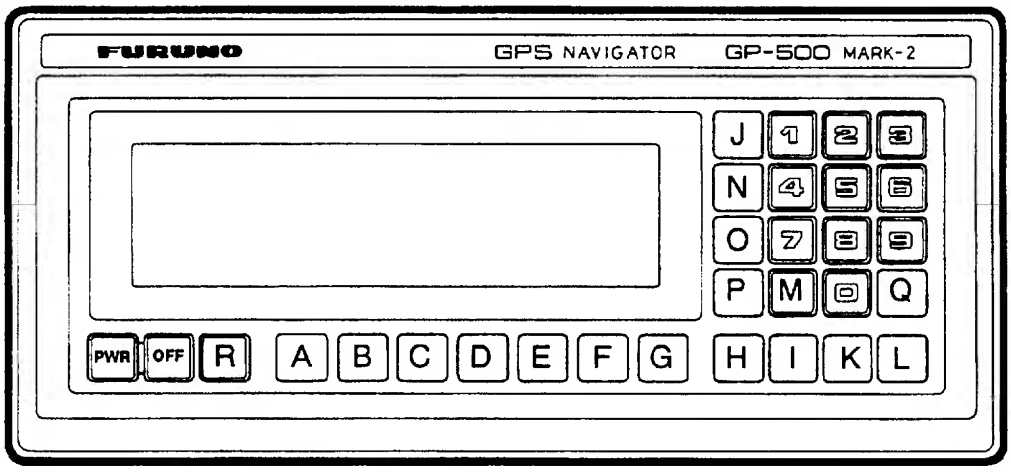


Figure 7-5a GP-500 MARK-2, showing key and associated indication in the keyboard test

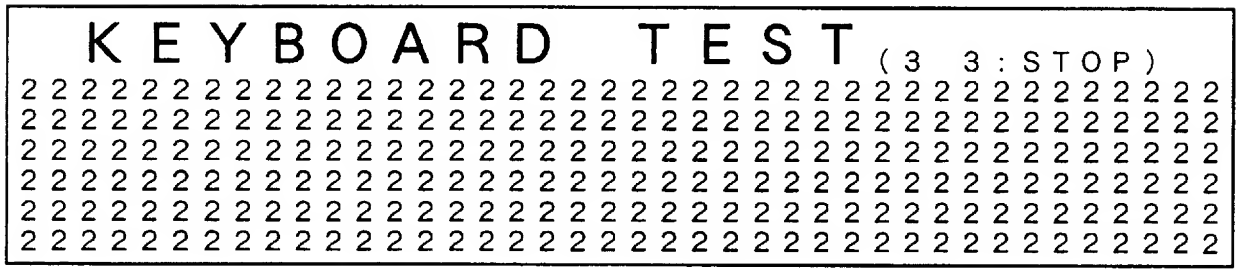


Figure 7-5b KEYBOARD TEST display, [2] key pressed

3) To escape from the test press the 3 key twice.

Clearing the Memory

You can clear all or specific memory banks. Clear all memories when the error indication "DERR" appears on the display, and clear specific memories when they contain errors.

Clearing all memories (including almanac)

1) Press MENU, 9, 8 and 2.

2) Press ▼. The MEMORY CLEAR display appears.

```
MEMORY CLEAR
DATA   CLEAR  =  ---   ( 1 : YES   )

➡ALL   CLEAR  =  ---   ( 1 : YES   )
```

Figure 7-6 MEMORY CLEAR display

3) Press CLR, 1 and ENT. The unit starts clearing all memories.

When all memories are cleared, the screen is cleared, and then the MEMORY CLEAR display appears.

Receive the almanac to fix your position, as prescribed on page 7-11.

Clearing data memories

You can clear data memories when, for example, they contain error. Note that the waypoint memory and the almanac are not cleared. The following data are cleared:

INITIAL DATA (1) ····· (MENU, 0)
INITIAL DATA (2) ····· (MENU, 9, 0)
DATUM SELECT ····· (MENU, 9, 1)
LOG/GYRO DATA ····· (MENU, 9, 2)
BACK UP NAV SELECT ····· (MENU, 9, 3)
MAGNETIC CORRECTION ···· (MENU, 9, 4)
DISPLAY UNIT ····· (MENU, 9, 5)
I/O DATA SELECT ····· (MENU, 9, 9)

1) Press MENU, 9, 8 and 2. The MEMORY CLEAR display appears.

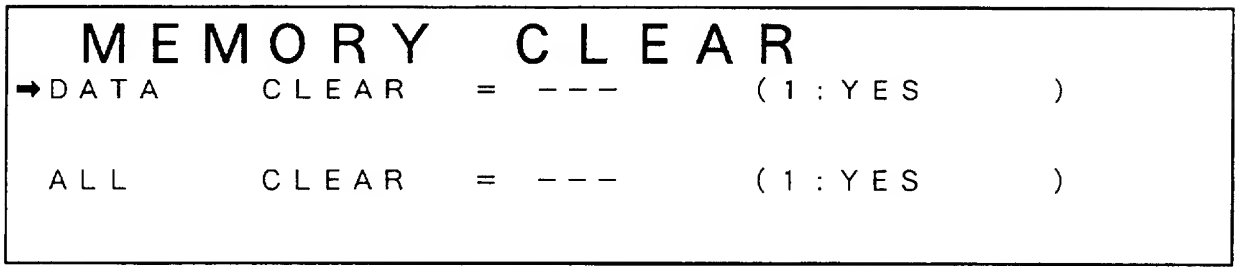


Figure 7-7 MEMORY CLEAR display

2) Press **CLR**, **1** and **ENT**.

When all data are cleared, the screen is cleared and then the MEMORY CLEAR display appears.

Cold Start

When the GP-500 MARK-2 has not been used for about 1 year or the memories have been cleared it takes considerable time to fix your position. (Note that extreme error in the present time or latitude and longitude position also cause this trouble.) This is because the existing almanac is too old to predict satellite arrival times. In this case conduct the cold start to receive the almanac and fix your position. It takes about 2 to 3 minutes to fix your position.

NOTE: *Estimated position should be within ten degrees. If it is more than ten degrees it may take more than 10 minutes to fix your position.*

1) Press **MENU**, **9** and **6**. The COLD START display appears. The display shows date and time existing almanac was received.

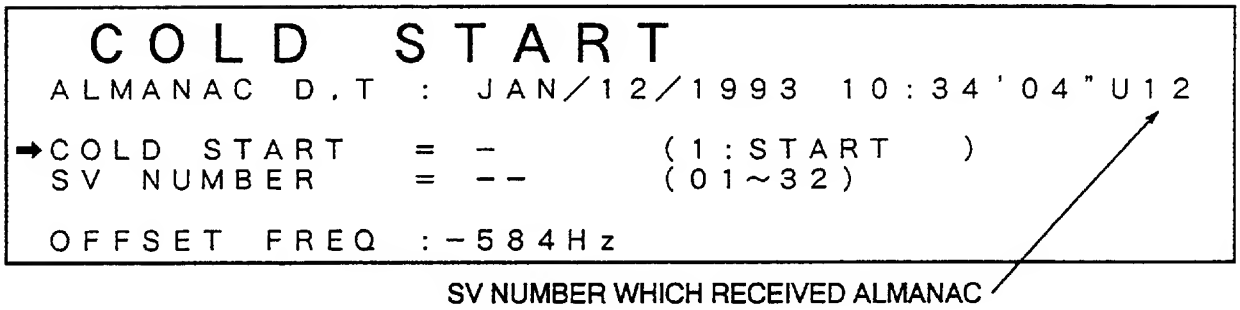


Figure 7-8 COLD START display

2) Press **CLR**, **1** and **ENT**. The existing almanac is cleared, indicated by erasing the information in "ALMANAC D, T," to acquire a satellite from which to receive the almanac.

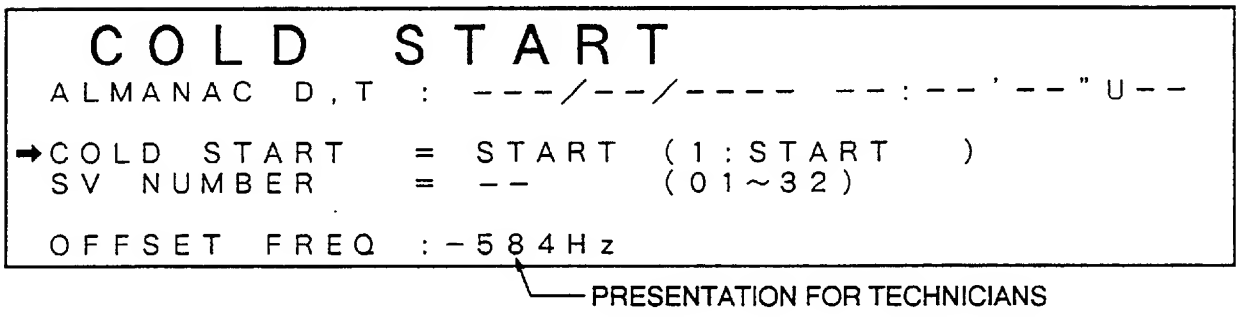


Figure 7-9 COLD START display, showing existing almanac is cleared

When almanac reception is completed, the date and time the almanac was received appears on the display.

INSTALLATION

Display Unit Installation

Mounting

Install the unit where the LCD can be easily viewed and the keyboard can be easily operated by referring to page D-2 or D-3.

The unit can be installed on the overhead, on a tabletop, or flush mounted in a panel. Be sure to leave a little slack in cables so the unit can be dismounted from the hanger with the connectors connected. This allows the service technician to work with a "live" set.

In addition to those points, observe the following precautions.

- Locate the unit out of direct sunlight because of heat which can build up inside the cabinet.
- The temperature and humidity of the mounting location should be stable and moderate.
- Locate the unit away from exhaust pipes and vents.
- The mounting location should be well ventilated.
- Mount the unit where shock and vibration are minimal.

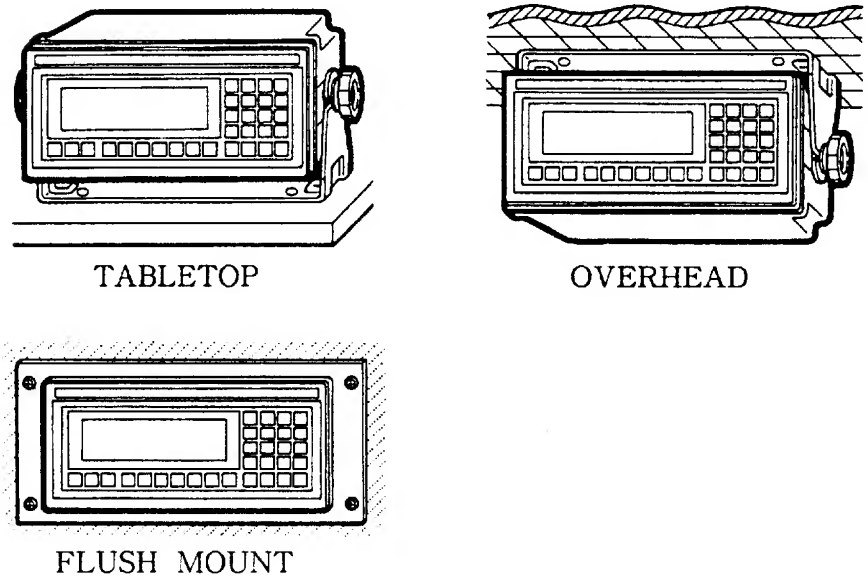


Figure 8-1 Display unit mounting methods

Antenna Unit Installation

Mounting considerations

When selecting a mounting location for the antenna unit keep in mind the following points.

- Install the unit outside of the radar beam. The radar beam will obstruct or prevent reception of the GPS satellite signal.
- Locate the unit well away from antennas of communication equipment. See the next page for minimum separation distances.
- Be sure the location offers a clean line-of-sight to satellites. Objects within line-of-sight to a satellite, for example, a mast or funnel, may prevent reception or result in long-lasting "Acquire" or "Interrupt" condition.
- Mount the unit as high as possible. Mounting the antenna as high as possible keeps it free of water spray, which can interrupt reception of a GPS satellite signal.

Antenna cable length

The standard cable is 15m long. 30m length or 50m length cable is optionally available. This cable cannot be directly connected to the display unit since its diameter is too large. The basic procedure for attaching the cable to the antenna unit is as follows.

1) Cut the cable to appropriate length (if necessary).
2) Fabricate the end of antenna cable and attach the coaxial connector. Details are shown on next page.

◆ Waterproofing the connector

Wrap connector with vulcanizing tape and then vinyl tape. Bind the tape end with cable-tie.

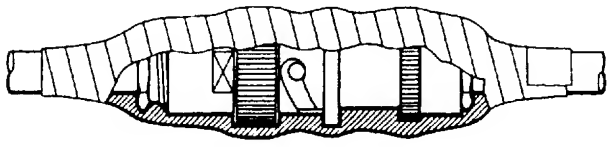
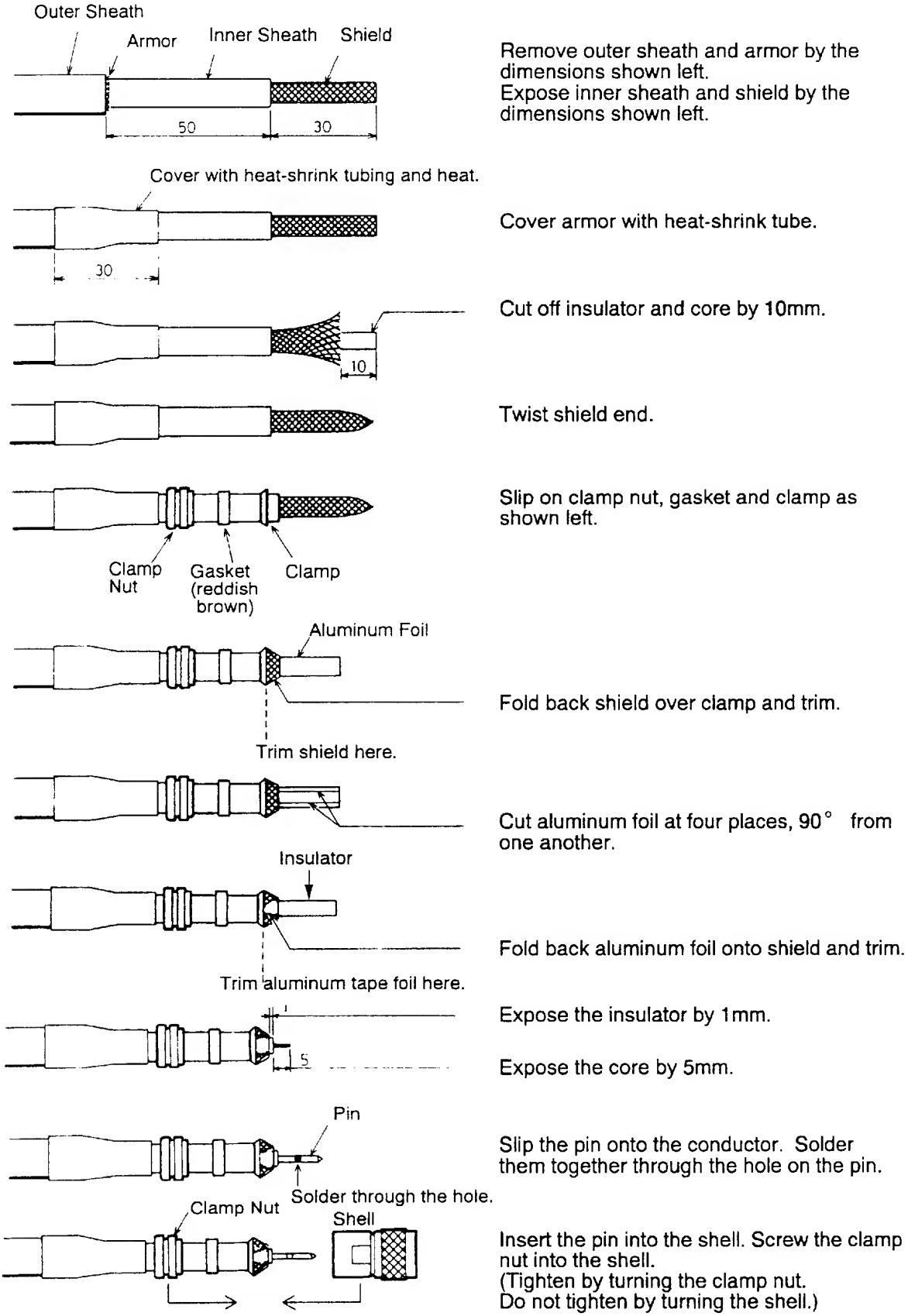


Figure 8-2 How to waterproof the antenna connector

How to attach the N-P-8DFB connector



Remove outer sheath and armor by the dimensions shown left.
Expose inner sheath and shield by the dimensions shown left.

Cover armor with heat-shrink tube.

Cut off insulator and core by 10mm.

Twist shield end.

Slip on clamp nut, gasket and clamp as shown left.

Fold back shield over clamp and trim.

Cut aluminum foil at four places, 90° from one another.

Fold back aluminum foil onto shield and trim.

Expose the insulator by 1mm.

Expose the core by 5mm.

Slip the pin onto the conductor. Solder them together through the hole on the pin.

Insert the pin into the shell. Screw the clamp nut into the shell.
(Tighten by turning the clamp nut.
Do not tighten by turning the shell.)

Figure 8-3 How to attach the N-P-8DFB connector

Table 8-2 Antenna cable and plug compatibility

Cable		Connection Diagram	Necessary Plug			Remarks
Max. Length	Type		Type	Code No.	Qty	
15m	3D-2V 3D-QEV 3D-XV	A	BNC-P117NI	000-112-144	2	
25m	5D-2V	A	BNC-P-5	000-500-397	2	
30m	RG-8/U	B	UG-21D/U	Local Supply	2	BNC-N Connector Conversion Adapter (000-123-810) Conversion Cable Assy. NJBP-3DXV-1 (000-117-602)
35m	8D-2V	B	N-P-8	000-501-512	2	
45m	5D-FB	B	N-P-5	000-107-861	2	
65m	8D-FB	B	N-P-8DFB	000-111-549	2	
83m	10D-FB	B	N-P-10	000-501-517	2	

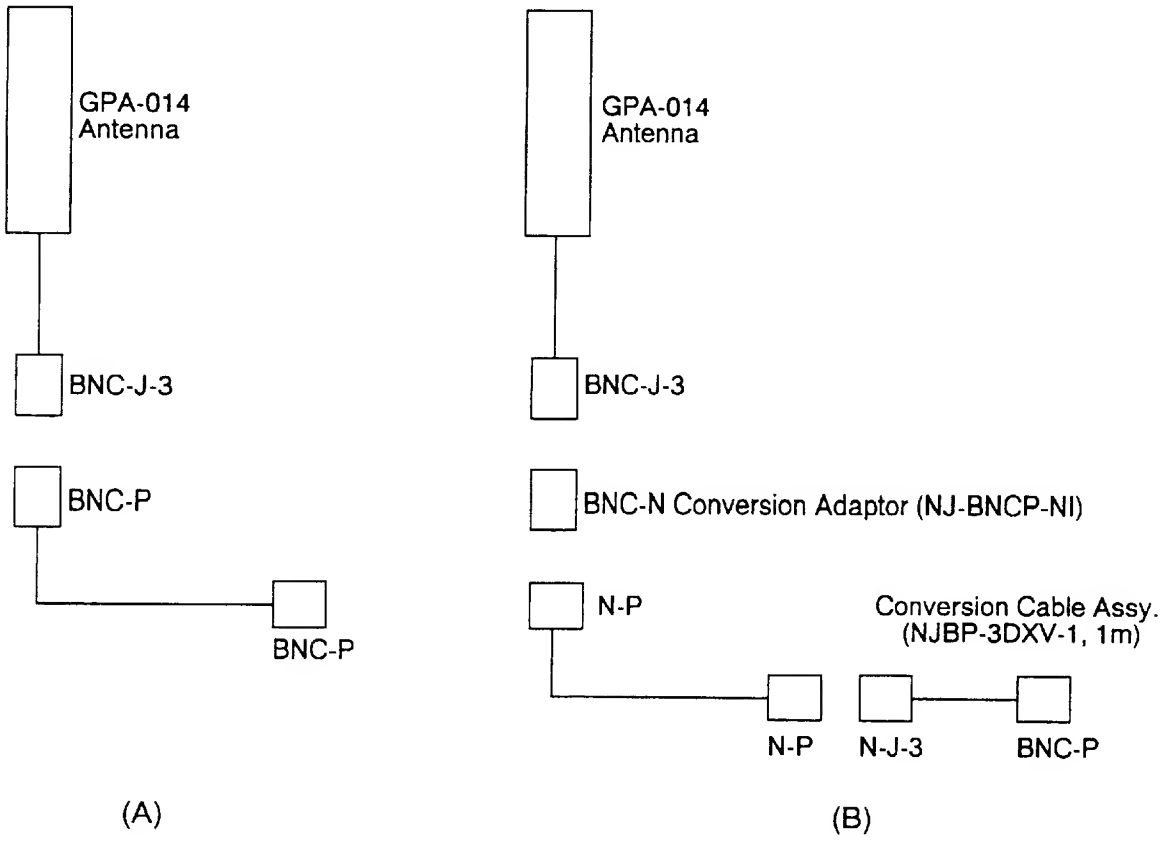


Figure 8-4 Adaptor plugs and connection method

Connections on the display Unit

Connect the antenna cable, the copper strap, the power cable and external equipment to the display unit as shown in Figure 8-5.

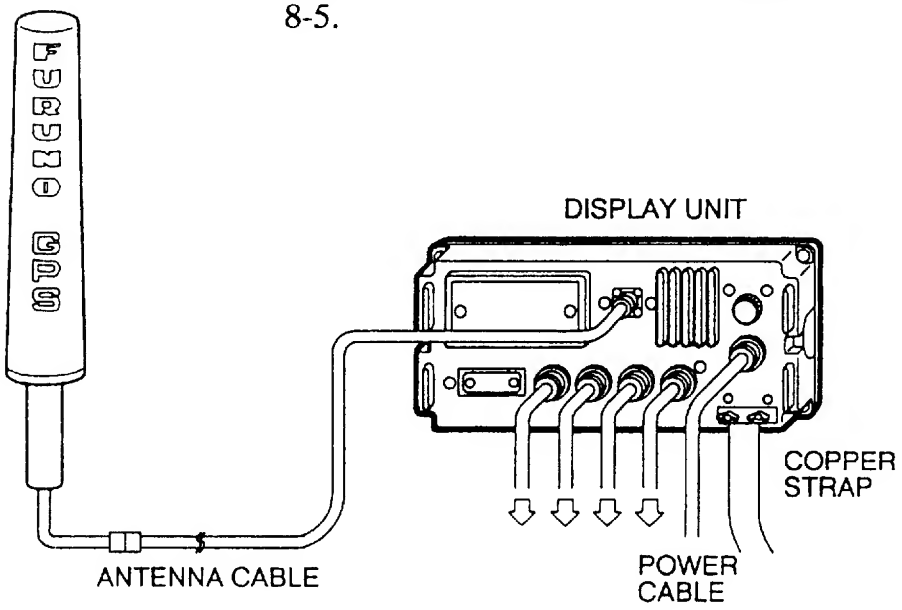


Figure 8-5 Connections

External equipment

The DATA OUT, DATA IN, GYRO, LOG, and DATA IN/OUT terminals either output position information to external equipment such as a radar, an echo sounder, a plotter, etc. or receive speed and heading data. A signal cable comes with the GP-500 MARK-2 for connection with external equipment. One end of the cable is prefitted with a connector. Connect it to appropriate connector. Attach a connector to the other end of the cable and connect it to external equipment.

Contact closure signal output representing ship's speed is available on LOG connector. This output is not the bypassed log signal input, but is generated by the GP-500 MARK-2 in accordance with the speed data which is obtained by GPS-reception or back-up navaid. Ratings of the relay contact are as follows.

	Resistance Load ($\cos \phi$ =1)	Inductance Load ($\cos \phi$ =0.4, L/R=7ms)
Raring	125Vac 0.4A 30Vdc 2.0A	125Vac 0.2A 30Vdc 1.0A

An external buzzer may be connected. Contact closure signal is output, and you mat connect a horn for a car, etc. The ratings for the relay contact are same as the one shown above.

Entering Initial Data

After installing the unit, enter initial data as follows.

Entering estimated latitude and longitude, antenna height

1) Press the [PWR] key.

2) Press [MENU] and [0]. The INIT DATA (1) display appears.

```
   I N I T   D A T A ( 1 )                    (▼:NEXT)
➡DATE     (M/D/Y)  =  12/01/1992
 TIME               =  13:25'00"U
 LOCAL ZONE TIME=+00H00M
 LAT                =  38°00.00'N
 LONG               = 123°00.00'W
 POSITION MODE      =  2D(1:2D 2:2D3D)
```

Figure 8-6 INIT DATA (1) display

3) Press [▼] three times. Entry of date and time is not required. They are corrected when the unit receives a GPS satellite. To use local time instead of UTC, enter time difference on second line.

4) Enter estimated latitude within 10 degrees of actual position. Use the [+/-] key to switch coordinate from North to South and vice versa.

[CLR][][]° [][].[][]' ([+/-])

5) Press the [ENT] key.

6) Press [▼].

7) Enter estimated longitude within 10 degrees of actual position. Use the [+/-] key to switch coordinate from West to East and vice versa.

[CLR][][][]° [][].[][]' ([+/-])

8) Press the [ENT] key.

9) Press [▼] three times.

10) Enter height of antenna above the waterline in meters.

[CLR] [ ] [ ] [ ] [ ] [ENT]

Correct input of the antenna height above the waterline is essential for accurate determination of position. This data is used in 2D position fixing only.

11)Press the [SPD CRS] key. The GP-500 MARK-2 starts acquiring a satellite to fix its position. This takes from 15 to 45 minutes. 2D appears on the display when position fixing is completed.

NOTE: *Do not change the setting of MASK ELEVATION (default setting 5°).*

Selecting back-up navigator

GPS position fixes is available almost 24 hours a day from January 1993. Therefore, a back-up navigator is rarely needed. However, select the navigator which is to feed position information during no GPS position fixing as follows.

1) Press [MENU], [9] and [3]. The BACK UP NAV SELECT display appears.

```
  B A C K   U P   N A V   S E L E C T
➡B A C K   U P   N A V        =  N O N E
              ( 1 : N O N E   2 : G P D R   3 : N N D R   4 : L R N - A
                5 : L R N - C   6 : O M G   7 : D E C    8 : I I   N A V )
 G P S   P O S N   C O R R E C T    =    N O   ( 1 : Y E S   0 : N O )
 G P S   C O R   S M O O T H I N G  =    9     ( 0 ~ 9 )
 G P S   C O R R E C T   V A R      :    0 . 0 0 0 ' N 0 . 0 0 0 ' W
```

Figure 8-7 BACK UP NAV SELECT display

2) Press [CLR], [ ] and [ENT].

1: No navigator connection. Your position is fixed (as long as three or four satellites are within line of sight) by GPS. When there is no GPS position fixing the position display freezes.
2: GPDR = Dead reckoning; log or gyrocompass
3: NNDR = Satellite navigator
4: LRN-A = Loran A
5: LRN-C = Loran C
6: OMG = Omega
7: DEC = Decca

3) Press [▼].

4) Enter GPS position correction. Usually a constant difference exists between GPS and back-up navigator position fixes. This causes the position display to change when switching between GPS and back-up navigator.

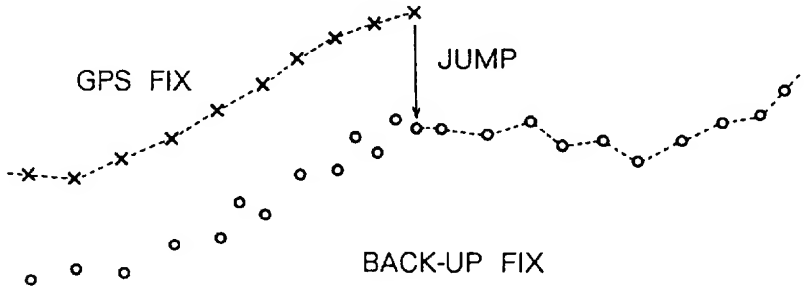


Figure 8-8 What happens to position display when switching from GPS to back-up navigator

The GPS fix is so more reliable than that of the back-up navigator, enter 1 (yes) to correct the back-up fix. Enter 0 for no correction.

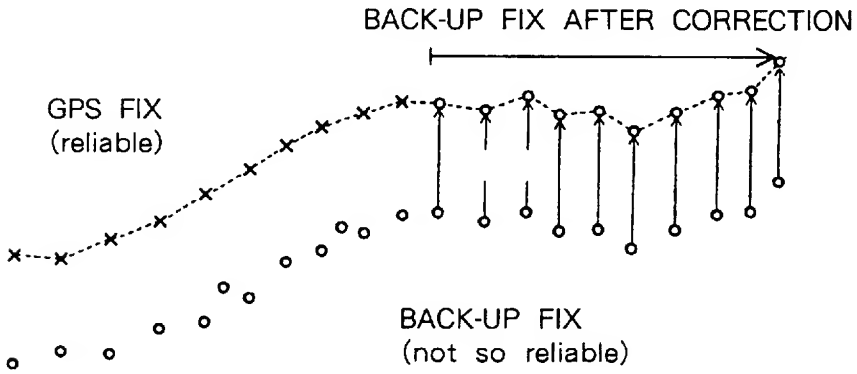


Figure 8-9 Effect of GPS position correction

5) Press [▼].

6) Enter GPS position correction smoothing, if necessary. The correction, illustrated in Figure 8-17, is determined by averaging the differences between the GPS and back-up navigator position fixes. Enter the averaging period here.

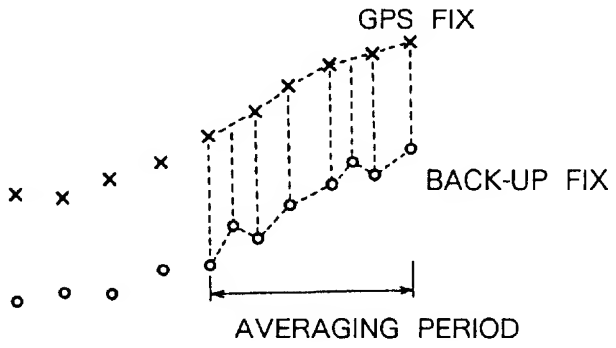


Figure 8-10 GPS correction smoothing

If the GPS or the back-up position is unstable, use a higher setting to get a longer averaging period. Enter 0 for no smoothing. For no smoothing, the correction value is given as the difference between the last GPS position fix and the back-up position fix at the time of the switching.

GPS correction value appears at the bottom of the display.

Selecting speed log and gyrocompass

If GPDR is selected as back-up navigator enable automatic or manual input of speed and heading data. (Manual input of speed and heading is necessary if you require the set and drift display.) If GPDR is selected but there is no log or gyrocompass see page 5-7 for further details.

1) Press **MENU**, **9** and **2**. The LOG GYRO display appears.

```
LOG・GYRO DATA                    (▼:GYRO)
➡LOG      = AUTO      (1:AUTO   0:MANUAL)
 SPD      = LOG       (1:LOG    0:NMEA  )
 LOG IN   = CONTACT   (1:CONTACT 0:TTL  )
 LOG PULSE(IN)  =  200P/NM  (100~500P/NM)
                            (9000~30000P/NM)
 LOG PULSE(OUT) =    0P/NM  (   0~500P/NM)
```

Figure 8-11 LOG GYRO DATA display (first page)

For speed log or external navigator connection;

2) Press **CLR**, **1** and **ENT** to select AUTO.

3) Press [▼].

4) Select source of speed information.

[CLR][ ][ENT]

1, log; 0, NMEA

If a navigator is connected to the DATA IN or DATA IN/OUT connector and outputs speed data (VHW) in NMEA 0183 format it can be used for dead reckoning.

5) Press [▼].

6) Select signal type of speed log.

[CLR][ ][ENT]

1, contact closure; 0, TTL level

7) Press [▼].

8) Select log pulse ratio for input (pulses/nautical mile).

[CLR][ ][ ][ ][ ][ENT]

(100 to 500 or 9,000 to 30,000)

9) Press [▼].

10) Select log pulse ratio for output.

[CLR][ ][ ][ ][ENT]

(0 to 500)

You may output the speed signal (pulse signal) for external equipment measured by GPS. Enter 0 for no speed log output.

11) Press [▼].

For gyrocompass or external navigator connection;

12) Press [CLR], [1] and [ENT] to select AUTO.

```
  LOG • GYRO  DATA                    (▼:LOG    )
➡GYRO     =  AUTO      (1:AUTO   0:MANUAL)
 HDG      =  GYRO      (1:GYRO   0:NMEA   )

 SET/DFT  SMOOTHING  =  5  (0~9)
```

Figure 8-12 LOG GYRO DATA display (second page)

13) Press [▼].

14) Enter source of heading information.

[CLR] [ ] [ENT]

1, gyro; 2, NMEA

If a navigator is connected to DATA IN or DATA IN/OUT connector and outputs heading data (VHW) in NMEA 0183 format it can be used in dead reckoning.

15) Press [▼].

16) Enter set and drift smoothing.

[CLR] [ ] [ENT]

(0 to 9)

"5" is the standard setting.

Selecting communication format

Select communication format for DATA IN, DATA OUT, and DATA IN/OUT connectors. When you select a format for DATA IN, the same format is selected for DATA OUT, and vice versa.

NOTE: *The GP-500 MARK-2 can output and receive various data in CIF or NMEA format. When selecting format be sure the connected equipment is able to handle data to be output.*

DATA IN connector

This connector carries data from the back-up navigator. Note that this connector can also output autopilot information. More on this later.

1) Press MENU, 9, 9 and 0. The DATA IN CONNECTOR display appears.

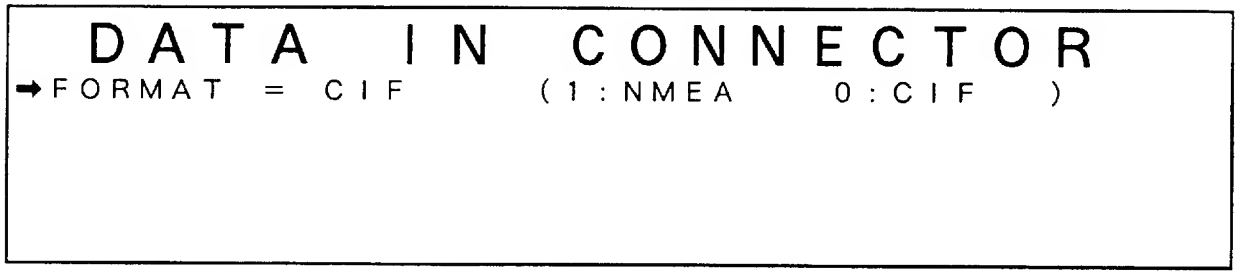


Figure 8-13 DATA IN CONNECTOR display

2) Select format.

CLR ENT

1, NMEA 0183; 0, CIF

The DATA IN connector can receive the following sentences:

FURUNO CIF: Present latitude, longitude, speed and course
NMEA 0183: GLL (present latitude and longitude), VHW (heading, water tracking speed) and VTG (course, ground tracking speed)

NOTE *VHW is required when GPDR is selected as back-up navigator and NMEA 0183 as speed and heading information source.*

DATA OUT connector

This connector is normally used to connect display devices such as plotter or video color sounder.

For CIF format;

1) Press MENU, 9, 9 and 1. The DATA OUT CONNECTOR display appears.

```
  D A T A   O U T   C O N N E C T O R
➡F O R M A T       =  C I F  ( 1 : I E C      0 : C I F    )
 O U T  D A T A    =  L / L : 0 1  R / B : 6 0  S / C : 0 1  H G T : 0 1
 D A T A  C H A N G E          =  L A  ( 0 : - -  1 : D R  2 : L A
                                         3 : L C  4 : O M  5 : D C  )
 G P S  D A T A  O U T         =   O N ( 1 : O N  0 : O F F  )
 G P S  E R R  C O D E  O U T  =   O N ( 1 : O N  0 : O F F  )
```

Figure 8-14 DATA OUT CONNECTOR display

2) Press [CLR], [0] and [ENT] to select CIF.

3) Press [▼].

4) Enter transmission interval (00, 01, 02, 03, 04, 05, 10, 12, 15, 20, 30, 40, 50, 60 or 90 seconds) for each of the following sentences. Enter 00 to disable transmission.

[CLR] □□□□□□□□ [ENT]

L/L R/B S/C HGT

L/L ··· latitude and longitude position
R/B ··· range and bearing from present position to TO waypoin
S/C ··· speed and course
HGT ·· altitude obtained by 3-dimensional position fix

5) Press [▼].

6) Select navigator for data (format) change.

[CLR] □ [ENT]

The GPS fix sentence is relatively new so some late model equipment may not recognize it. In this case both GPS and back-up position fixes may be transmitted in the format of a conventional navaid, one the external equipment recognizes. Select sentence as follows.

0: — — = GPS navigator
1: DR = Satellite navigator
2: LA = Loran A
3: LC = Loran C
4: OM = Omega
5: DC = Decca

7) Press [▼].

8) Select how to output GPS data.

[CLR] [ ] [ENT]

Enter 1 to transmit both GPS and back-up position fixes in GPS format and dummy format. For GPS format only, enter "0." at step 6 and "1" at this step.

9) Press [▼].

10) Select whether to output GPS error code.

Enter 1 to transmit back-up position fix with GPS error code. Enter 0 to output original error code from back-up navaid. Normally, select 0.

For IEC 1162-1 format;

1) Press [MENU], [9], [9] and [1]. The DATA OUT CONNECTOR display appears.

GP: data format selected at previous page.

```
DATA OUT CONNECTOR
➡FORMAT     =  IEC1162(1:IEC0:CIF,  ) GP 93%
 INTERVAL   =  AAM:04 APA:00 APB:00 BOD:04
 INTERVAL   =  BWC:04 BWW:00 GGA:10 GLL:01
 INTERVAL   =  RMB:00 RMC:00 VDR:10 VTG:01
 INTERVAL   =  WCV:00 WNC:00 WPL:60 XTE:04
 INTERVAL   =  ZDA:01 ZLZ:00 ZTG:00
```

Figure 8-15 DATA OUT CONNECTOR display

2) Press [CLR], [1] and [ENT] to select IEC.

3) Press [▼].

4) Enter transmission interval for each of the following sentences.

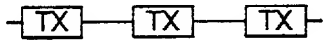
[CLR] [ ][ ] [ ][ ] [ ][ ] [ ][ ] [ENT]

AAM APA APB BOD

Choose from 00, 01, 02, 03, 04, 05, 10, 12 ,15, 20, 30, 40, 50, 60 and 90 seconds. Enter 00 for no transmission.

5) Repeat steps 3 and 4 to select transmission intervals for remaining sentences.

The TX rate of operation is the percentage of data output in one second, and it appears at the top right-hand corner on the screen. If short intervals are assigned to many sentences, the rate of operation increases as illustrated below.



A rate of operation exceeding 100% is impractical. For better performance, the rate of operation should not exceed 93%, the default setting.

NOTE 1: *During back-up periods, sentences are transmitted with the talker ID "GP." However, the sentence contains error flags (for example, APA, XTE) to signify the position data is not by GPS. If there is no external navigator, speed and course information from dead reckoning are output during back-up periods.*

NOTE 2: *The GPS fix sentence is relatively new so some late model equipment may not recognize it. In this case both GPS and back-up position fixes may be transmitted in the format of a conventional navaid, one the external equipment recognizes. Select one as follows.*

(1) Temporarily select CIF format by pressing at the DATA OUT CONNECTOR display (MENU, 9, 9 and 1). Select suitable talker on the DATA CHANGE line.

0: GP = GPS Navigator
(No transmission with a dummy format)
1: DR = Satellite navigator
2: LA = Loran A
3: LC = Loran C
4: OM = Omega
5: DC = Decca

(2) Select IEC 1162-1 format.

If you do not need to change the talker name, temporarily select the CIF format and confirm that "0" is selected.

NOTE 3: *GPGLL (latitude and longitude) is output with the resolution of 0.001. The resolution level for other talkers is 0.01.*

NOTE 4: *The type of IEC 1162-1 and NMEA 0183 data which can be transmitted is as follows;*

IEC 1162-1 sentences

AAM: Arrival alarm
APB: Autopilot format B
BOD: Bearing to TO waypoint from FROM waypoint
BWC: Range and bearing to waypoint (great circle navigation)
BWW: Bearing to waypoint

GGA: GPS position fixing condition (time of fix, latitude, longitude, receiving condition, number of satellites used, DOP)
GLL: Latitude and longitude
RMB: Generic navigational information (cross track error, steering direction starting waypoint no., destination waypoint no., latitude and longitude of starting waypoint, latitude and longitude of destination waypoint, range and bearing to waypoint, range and bearing from present position to destination waypoint, velocity to destination, arrival alarm)
RMC: Generic navigational information (UTC time latitude, longtitude, ground speed, true course, day, month, year)
VDR: Set and drift
VTG: Actual track and ground speed
WCV: Waypoint closure velocity
WNC: Range to TO waypoint in great circle
WPL: Waypoint position
XTE: Cross track error
ZDA: UTC, local zone time
ZTG: Time to go to waypoint

NMEA 0183 sentences

APA: Autopilot format A
ZLZ: UTC, day, month, year

DATA IN/OUT connector

This connector can receive RS-232C data and differential receiver data (RS-422) and output IEC 1162-1 data. It accepts display device or differential receiver.

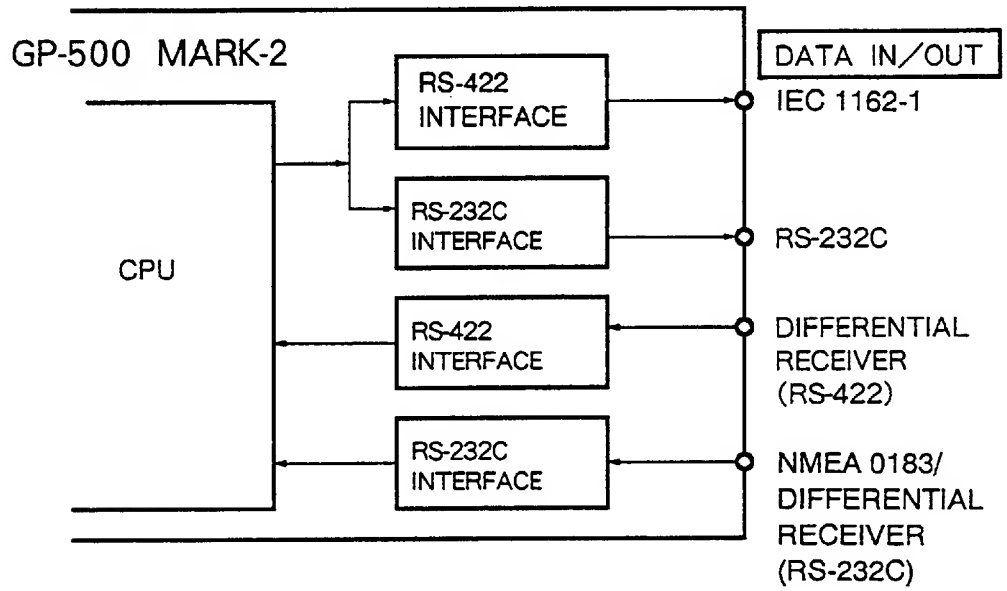


Figure 8-16 DATA IN/OUT connector

1) Press **MENU**, **9**, **9** and **2**. The D. IN/OUT CONNECTOR display appears.

```
  D. IN/OUT CONNECTOR
 FORMAT      :  RS232C                                  93%
➡INTERVAL    =  AAM:04  APA:00  APB:00  BOD:04
 INTERVAL    =  BWC:04  BWW:00  GGA:10  GLL:01
 INTERVAL    =  RMB:00  RMC:00  VDR:10  VTG:01
 INTERVAL    =  WCV:00  WNC:00  WPL:60  XTE:04
 INTERVAL    =  ZDA:01  ZLZ:00  ZTG:00
```

Figure 8-17 D. (ata)IN/OUT CONNECTOR display

2) Enter transmission interval for each of the following sentences.

CLR □□ □□ □□ □□ **ENT**

AAM APA APB BOD

Choose from 00, 01, 02, 03, 04, 05, 10, 12 ,15, 20, 30, 40, 50, 60 and 90 seconds. Enter 00 for no transmission.

3) Press ▼.

4) Repeat steps 2 and 3 to select transmission intervals for remaining sentences.

NOTE 1: *All sentences transmitted with the talker ID "GP."*

NOTE 2: *GPGLL (latitude and longitude) is output with the resolution of 0.001.*

NOTE 3: *During back-up periods, sentences are transmitted with talker ID "GP." However, the sentence contains error flags (for example, APA, XTE) to signify the position data is not by GPS. If there is no external navigator, speed and course information from dead reckoning are output during back-up periods.*

NOTE 4: *RS-232C is the standard communication format. It mainly specifies electrical characteristics of signals and some handshake controls for data exchange. Sentences are prepared at the connected equipment (personal computer, etc.). The DTR output is inserted continuously; the DSR input is not available.*

Autopilot connection

An autopilot may be connected either to the #1 and #2 pins of DATA IN or the #3 and #4 pins of the DATA OUT. Any other device may also be connected to these pins.

For IEC 1162-1;

1) Press [MENU], [9], [9] and [3]. The AUTO PILOT DATA display appears.

```
AUTO PILOT DATA
➡FORMAT     = IEC(1:IEC1162 0:NMEA180)  46%
 INTERVAL   = AAM:04 APA:00 APB:00 BOD:04
 INTERVAL   = BWC:04 BWW:00 GGA:00 GLL:00
 INTERVAL   = RMB:00 RMC:00 VDR:00 VTG:04
 INTERVAL   = WCV:00 WNC:00 WPL:00 XTE:04
 INTERVAL   = ZDA:00 ZLZ:00 ZTG:00
```

Figure 8-18 AUTO PILOT DATA display

2) Press [CLR], [1] and [ENT] to select IEC 1162-1.

3) Press [▼].

4) Enter transmission interval for each of the following sentences.

CLR □□ □□ □□ □□ ENT

AAM APA APB BOD

Choose from 00, 01, 02, 03, 04, 05, 10, 12 ,15, 20, 30, 40, 50, 60 and 90 seconds. Enter 00 for no transmission.

5) Repeat steps 3 and 4 to select transmission intervals for remaining sentences.

NOTE 1: *All sentences transmitted with the talker ID "GP."*

NOTE 2: *During back-up periods, sentences are transmitted with talker ID "GP." However, the sentence contains error flags (for example, APA, XTE) to signify the position data is not by GPS. If there is no external navigator, speed and course information from dead reckoning are output during back-up periods.*

For NMEA 0180;

1) Press MENU, 9, 9 and 3.

```
AUTO PILOT DATA
➡FORMAT    = 180 (1:IEC1162 0:NMEA180)
 INTERVAL  = XTE:01 (01~05)
```

Figure 8-19 AUTO PILOT DATA display

2) Press CLR, 0 and ENT to select NMEA 0180.

3) Press ▼.

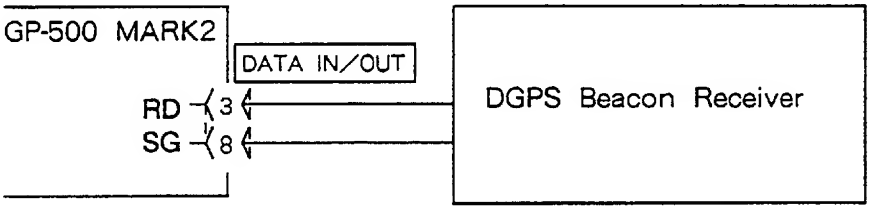
4) Enter transmission interval (01 to 05 seconds). Enter 00 for no transmission.

CLR □□ ENT

Connecting DGPS Beacon Receiver

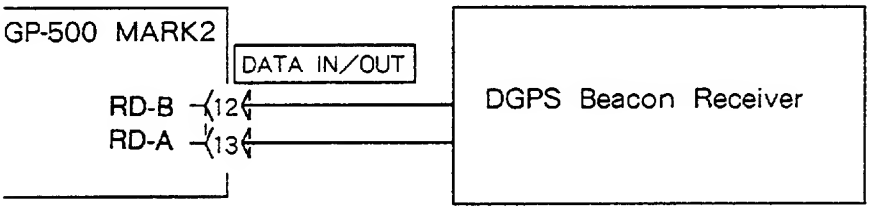
DGPS Beacon Receiver is connected to the terminal "DATA IN/OUT". However pin numbers to be connected are different for signal levels RS-232C and RS-422.

1) When signal level of DGPS Beacon Receiver is RS-232C.

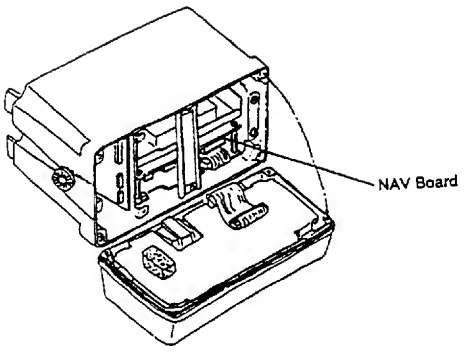


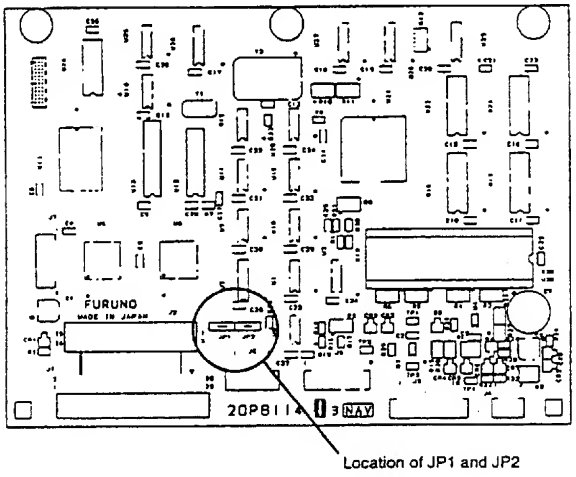
JP1 and JP2 on NAV Board are shorted in the factory setting.

2) When signal level of DGPS Beacon Receiver is RS-422.



Remove jumper wires JP1 and JP2 on NAV Board.



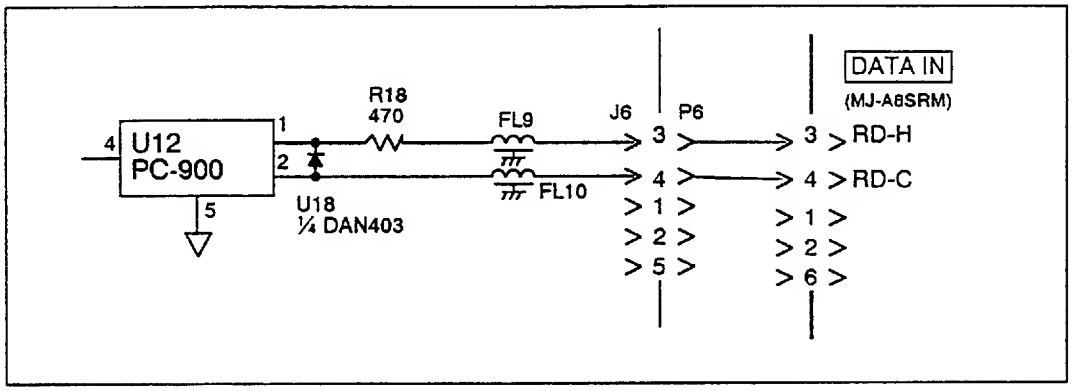


Interface documentation

"DATA IN" port

• NMEA 0183 Ver. 1.5/FURUNO CIF Sentence

• Input Schematic Diagram (Listener)



• Load requirements

Isolation: opto coupler
Input impedance: 470 ohm
Max voltage: ± 15 V
Threshold: 3mA
(In case of FURUNO device talker connection)

• Input Sentence List

NMEA 0183 Ver. 1.5 Sentence

Ckecksum is checked if attached and if any errors are found, the sentence becomes invalid.

GLL:Geographical position - latitude/longitude

$--GLL, 3444.50, N, 13521.30, E*23<CR><LF>
a b c d e

a:Latitude b:N/S c:Longitude d:E/W e:checksum

VTG:Course over ground and ground speed

$--VTG, 123.0, T, 130.0, M, 23.4, N, 43.3, K*12<CR><LF>
a b c d e f g h i

a, b:Course degrees true c, d:Course degrees magnetic e, f:Speed knots
g, h:Speed km/h i:checksum

VHW:Water speed and heading

$--VHW, 123.0, T, 130.0, M, 10.0, N, 18.5, K*34<CR><LF>
a b c d e f g h i

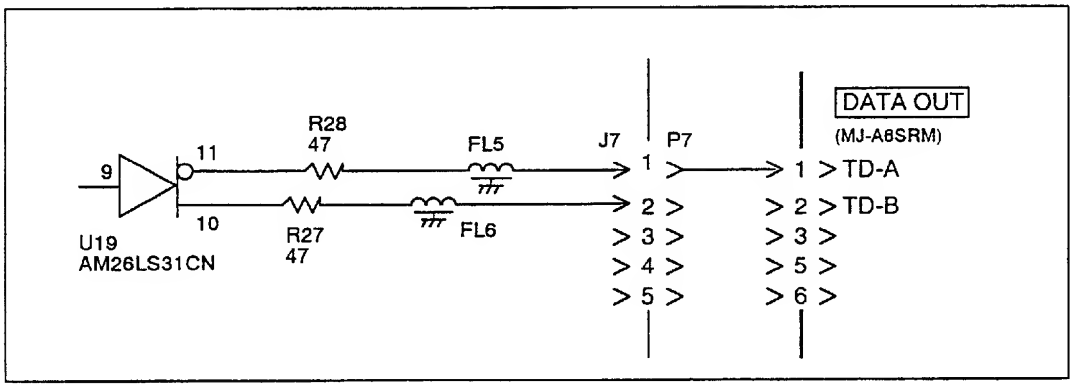
a, b:Heading, degrees true c, d:Heading, degrees magnetic e, f:Speed, knots
g, h:Speed, km/h i:checksum

FURUNO CIF Data

Latitude and longitude position
Speed and course

"DATA OUT" port

- IEC 1162-1/FURUNO CIF Sentence
- Output Schematic Diagram



- Output drive capability
  max 10mA
- IEC 1162-1 Output is subject to the standard of IEC 1162-1 First edition 1995-11.

• Output Sentence List
Each sentence is output at the interval entered.

IEC 1162-1
Ckecksum is attached to all sentences.

AAM: Waypount arrival alarm
APB:Autopilot sentence B
"Heading to steer to destination waypoint data" is not used.
BOD:Bearing-origin to destination
BWC:Bearing and distance to waypoint-great circle
BWW:Bearing-waypoint to waypoint
GGA:Global positioning system (GPS) fix data
GLL:Geographic position-latitude/longitude
RMB:Recommended minimum navigation information
RMC:Recommended minimum specific GPS/TRANSIT data
VDR:Set and drift
VTG:Course over ground and ground speed
WCV:Waypoint closure velocity
WNC:Distance-waypoint to waypoint-great circle
WPL:Waypoint location
XTE:Cross-track error, measured
ZDA:Time and date
ZTG:UTC and time to destination waypoint

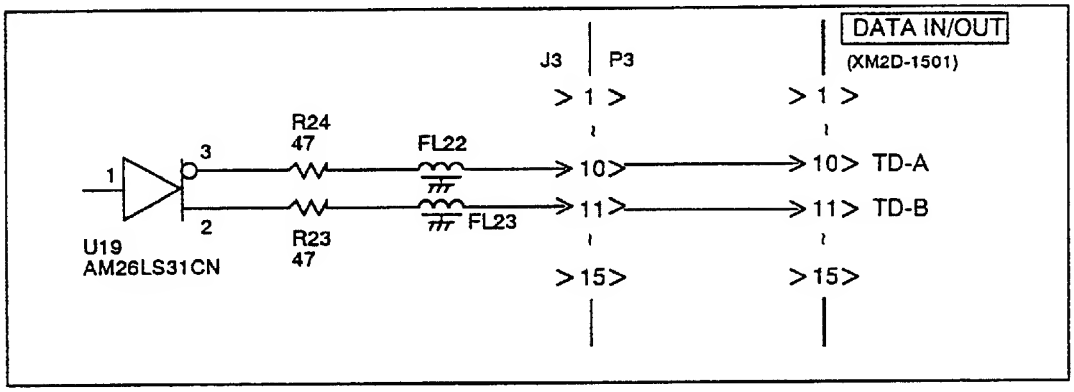
Also, following NMEA 0183 Ver. 1.5 sentences are output.
APA: Autopilot sentence "A" (Can be output in NMEA 0183 Ver. 1.5)
ZLZ: Time of day (Can be output in NMEA 0183 Ver. 1.5)

FURUNO CIF Data

Latitude and longitude position
Range and bearing from present position to destination waypoint
Speed and course
Altitude obtained by 3-dimensional position fix

"DATA IN/OUT" port

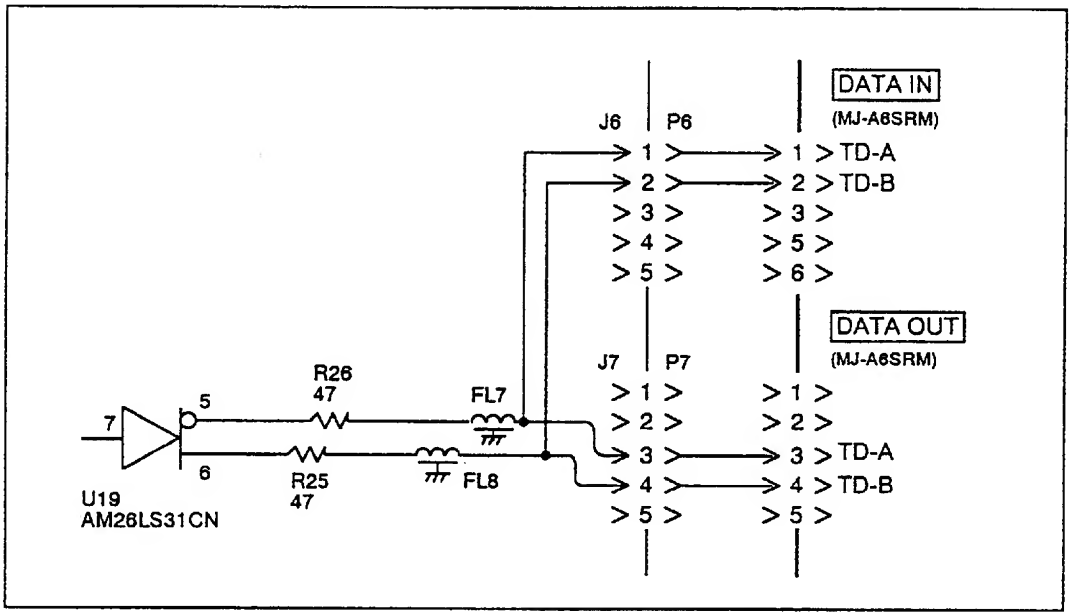
- IEC 1162-1 Sentence output
- Output Schenatic Diagram (Talker)



- Output drive capability
  max. 10 mA
- IEC 1162-1 out is subject to the standard of IEC 1162-1 first edition 1995-11.
- The same sentence data is output from #2 and #8 of "DATA IN/OUT" port in RS-232C level.
- Output sentences same as that for "DATA OUT" port.

"Autopilot Data" Port

- IEC 1162-1 Sentence/NMEA 0180 Data Output
- Output Schenatic Diagram (Talker)



- Output drive capability
  2 output total: max 10 mA
- IEC 1162-1 output is subject to the standard IEC 1162-1 first edition 1995-11.
- IEC 1162-1 output sentences are the same as that for "DATA OUT" port.

Specifications

ANTENNA UNIT

1) Number of Channels:	Eight channels parallel, eight satellite tracking ability
2) Receiving Frequency:	1575.42 MHz
3) Receiving Code:	C/A Code
4) Position Fixing Method:	All-in-view, 8-state Kalman filter
5) Positioning Accuracy:	Approx. 50 m. 95% of the time, Horizontal dilution of position (HDOP) $\leqq$ 4 Note: All GPS receivers are subject to degradation of position and velocity accuracies under the U.S. Department of Defence. DGPS: Approx. 5 m, 95% of the time [Option]
6) Tracking Velocity	900 kts
7) Satellite Acquisition Time:	Warm start, 20 seconds; Cold start, 2 minutes
8) Position Update Interval:	Every second

DISPLAY UNIT

1) Display:	240 x 64 dot matrix super twist LCD
2) Illumination:	Backslid by EL Board
3) Display Character:	alphanumeric characters
4) Function:	(1) latitude and longitude (Loran A, C or Decca LOP also), (2) time, (3) speed, (4) course, (5) waypoint (up to 200), (6) event position (up to 20), (7) route (0 to 9), (8) range to waypoint, (9) bearing to waypoint, (10) time-to-go to destination, (11) cross track error, (12) estimated time of arrival to waypoint, (13) arrival and anchor watch alarms, (14) Cross track

error and border alarms, (15) ship's speed alarm, (16) trip alarm.

DATA I/O

1) Input Port:	Speed log, gyrocompass, data in, one each
2) Output Port:	Data out, one
3) Input/Output Port:	One
4) Format:	IEC 1162-1, CIF, NMEA 0183S, NMEA 0183

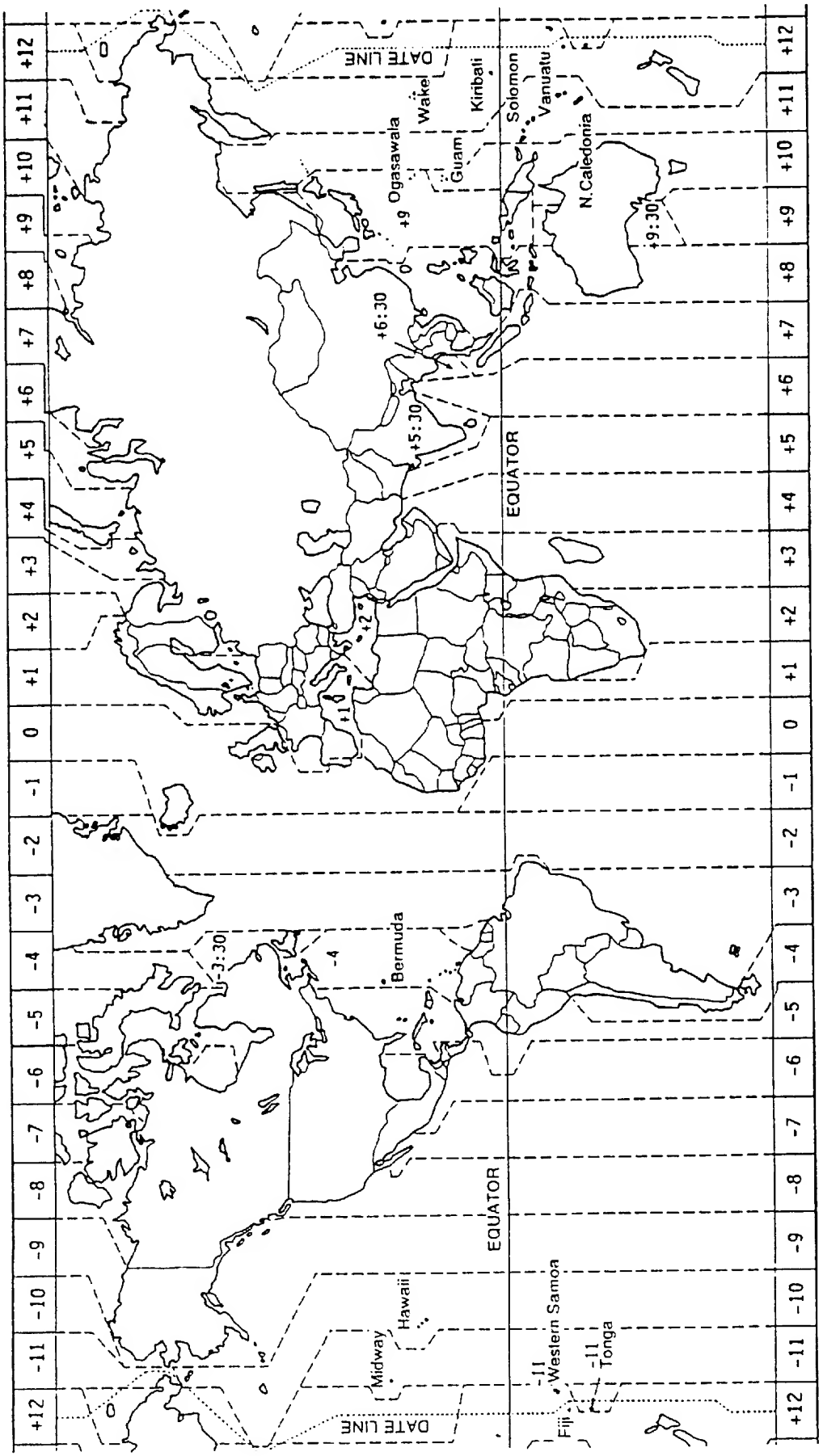
POWER SUPPLY & ENVIRONMENTAL CONDITIONS

1) Power Supply & Power Consumption:	10 V to 40 VDC, 12 W
2) Temperature:	Antenna: -25 to +70 ℃ Display: -15 to +55 ℃
3) Humidity:	95% at 40 ℃ (both antenna and display units)
4) Watertightness:	Antenna: waterproof Display: Splashproof
5) Vibration:	1 to 12.5 Hz, 3.2 nm pp 12.5 to 25 Hz, 0.8 nm pp 25 to 50 Hz, 0.2 nm pp

DIMENSIONS & WEIGHT

1) Dimensions:	Antenna: ϕ 52 x 290 mm Display: 115 x 250 x 200 mm
2) Weight:	Antenna: 0.5 kg Display: 4 kg

Time Differences



Geodetic Chart Systems

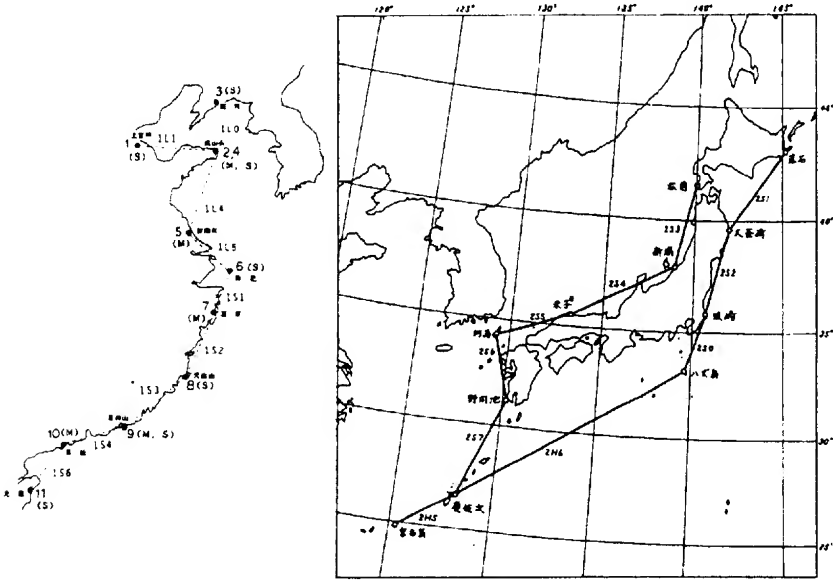
001 : WGS84
002 : WGS72
003 : TOKYO : Mean Value (Japan, Korea, and Okinawa)
004 : NORTH AMERICAN 1927 : Mean Value (CONUS)
005 : EUROPEAN 1950 : Mean Value
006 : AUSTRALIAN GEODETIC 1984 : Australia and Tasmania Island
007 : ADINDAN : Mean Value (Ethiopia and Sudan)
008 : Ethiopia
009 : Mali
010 : Senegal
011 : Sudan
012 : AFG : Somalia
013 : AIN EL ABD 1970 : Bahrain Island
014 : ANNA 1 ASTRO 1965 : Cocos Island
015 : ARC 1950 : Mean Value
016 : Botswana
017 : Lesotho
018 : Malawi
019 : Swaziland
020 : Zaire
021 : Zambia
022 : Zimbabwe
023 : ARC 1960 : Mean Value (Kenya, Tanzania)
024 : Kenya
025 : Tanzania
026 : ASCENSION ISLAND 1958 : Ascension Island
027 : ASTRO BEACON "E" : Iwo Jima Island
028 : ASTRO B4 SOR. ATOLL : Tern Island
029 : ASTRO POS 71/4 : St. Helena Island
030 : ASTRONOMIC STATION 1952 : Marcus Island
031 : AUSTRALIAN GEODETIC 1966: Australia and Tasmania Island
032 : BELLEVUE (IGN) : Efate and Erromango Islands
033 : BERMUDA 1957 : Bermuda Islands
034 : BOGOTA OBSERVATORY : Colombia
035 : CAMPO INCHAUSPE : Argentina
036 : CANTON ISLAND 1966 : Phoenix Islands
037 : CAPE : South Africa
038 : CAPE CANAVERAL : Mean Value (Florida and Bahama Islands)
039 : CARTHAGE : Tunisia
040 : CHATHAM 1971 : Chatham Island (New Zealand)
041 : CHUA ASTRO : Paraguay
042 : CORREGO ALEGRE : Brazil
043 : DJAKARTA (BATAVIA) : Sumatra Island (Indonesia)
044 : DOS 1968 : Gizo Island (New Georgia Islands)
045 : EASTER ISLANDS 1967 : Easter Island
046 : EUROPEAN 1950 (Cont'd) : Western Europe
047 : Cyprus
048 : Egypt
049 : England, Scotland, Channel, and Shetland Islands
050 : England, Ireland, Scotland, and Shetland Islands
051 : Greece
052 : Iran
053 : Italy - - Sardinia
054 : Italy - - Sicily
055 : Norway and Finland
056 : Portugal and Spain
057 : EUROPEAN 1979 : Mean Value
058 : GANDAJIKA BASE : Republic of Maldives
059 : GEODETIC DATUM 1949 : New Zealand
060 : GUAM 1963 : Guam Island
061 : GUX 1 ASTRO : Guadalcanal Island
062 : HJORSEY 1955 : Iceland
063 : HONG KONG 1963 : Hong kong
064 : INDIAN : Thailand and Vietnam
065 : Bangladesh, India, and Nepal
066 : IRELAND 1965 : Ireland
067 : ISTS 073 ASTRO 1969 : Diego Garcia
068 : JHONSTON ISLAND 1961 : Jhonston Island
069 : KANDAWALA : Sri Lanka
070 : KERGUELEN ISLAND : Kerguelen Island
071 : KERTAU 1948 : West Malaysia and Singapore
072 : LA REUNION : Mascarene Island
073 : L.C. 5 ASTRO : Cayman Brac Island
074 : LIBERIA 1964 : Liberia
075 : LUZON : Philippines (Excluding Mindanao Island)
076 : Mindanao Island
077 : MAHE 1971 : Mahe Island
078 : MARCO ASTRO : Salvage Islands
079 : MASSAWA : Eritrea (Ethiopia)
080 : MERCHICH : Morocco
081 : MIDWAY ASTRO 1961 : Midway Island
082 : MINNA : Nigeria
083 : NAHRWAN : Masirah Island(Oman)
084 : United Arab Emirates
085 : Saudi Arabia
086 : NAMIBIA : Namibia
087 : MAPARIMA, BWI : Trinidad and Tobago
088 : NORTH AMERICAN 1927 : Western United States
089 : Eastern United States
090 : Alaska
091 : Bahamas (Excluding San Salvador Island)
092 : Bahamas - - San Salvador Island
093 : Canada (Including Newfoundland Island)
094 : Alberta and British Columbia
095 : East Canada
096 : Manitoba and Ontario
097 : Northwest Territories and Saskatchewan
098 : Yukon
099 : Canal Zone
100 : Caribbean
101 : Central America
102 : Cuba
103 : Greenland
104 : Mexico
105 : NORTH AMERICAN 1983 : Alaska
106 : Canada
107 : CONUS
108 : Mexico, Central America
109 : OBSERVATORIO 1966 : Corvo and Flores Islands (Azores)
110 : OLD EGYPTIAN 1930 : Egypt
111 : OLD HAWAIIAN : Mean Value
112 : Hawaii
113 : Kauai
114 : Maui
115 : Oahu
116 : OMAN : Oman
117 : ORDNANCE SURVEY OF GREAT BRITAIN 1936 : Mean Value
118 : England
119 : England, Isle of Man, and Wales
120 : Scotland and Shetland Islands
121 : Wales
122 : PICO DE LAS NIVIES : Canary Islands
123 : PITCAIRN ASTRO 1967 : Pitcairn Island
124 : PROVISIONAL SOUTH CHILEAN 1963 : South Chile (near 53° S)
125 : PROVISIONAL SOUTH AMERICAN 1956: Mean Value
126 : Bolivia
127 : Chile - - Northern Chile (near 19° S)
128 : Chile - - Southern Chile (near 43° S)
129 : Colombia
130 : Ecuador
131 : Guyana
132 : Peru
133 : Venezuela
134 : PUERTO RICO : Puerto Rico and Virgin Islands
135 : QATAR NATIONAL : Qatar
136 : QORNOQ : South Greenland
137 : ROME 1940 : Sardinia Islands
138 : SANTA BRAZ : Sao Maguel, Santa Maria Islands (Azores)
139 : SANTO (DOS) : Espirito Santo Island
140 : SAPPER HILL 1943 : East Falkland Island
141 : SOUTH AMERICAN 1969 : Mean Value
142 : Argentina
143 : Bolivia
144 : Brazil
145 : Chile
146 : Colombia
147 : Ecuador
148 : Guyana
149 : Paraguay
150 : Peru
151 : Trinidad and Tobago
152 : Venezuela
153 : SOUTH ASIA : Singapore
154 : SOUTHEAST BASE : Porto Santo and Madeira Islands
155 : SOUTHWEST BASE : Faial, Graciosa, Pico, Sao Jorge, and Terceira Islands
156 : TIMBALAI 1948 : Brunei and East Malaysia (Sarawak and Sadah)
157 : TOKYO : Japan
158 : Korea
159 : Okinawa
160 : TRISTAN ASTRO 1968 : Tristan da Cunha
161 : VITI LEVU 1916 : Viti Levu Island (Fiji Islands)
162 : WAKE-ENIWETOK 1960 : Marshall Islands
163 : ZANDERIJ : Suriname
164 : BUKIT RIMPAH : Bangka and Belitung Islands (Indonesia)
165 : CAMP AREA ASTRO : Camp Mcmurdo Area, Antarctica
166 : G. SEGARA : Kalimantan Islands (Indonesia)
167 : HERAT NORTH : Afghanistan
168 : HU-TZU-SHAN : Taiwan
169 : TANANARIVE OBSERVATORY 1925 : Madagascar
170 : YACARE : Uruguay
171 : RT-90 : Sweden

Loran C/A Chain

Loran C Chain

CHAIN	GRI	S1	S2	S3	S4	S5
CENTRAL PACIFIC	4990	11	29	– –	– –	– –
CANADIAN EAST COAST	5930	11	25	38	– –	– –
COMMANDO LION (Korea)	5970	11	31	42	– –	– –
CANADIAN WEST COAST	5990	11	27	41	– –	– –
SOUTH SAUDI ARABIA	7170	11	26	36	52	– –
LABRADOR SEA	7930	11	26	– –	– –	– –
EASTERN RUSSIA	7950	11	30	46	61	– –
GULF OF ALASKA	7960	11	26	– –	– –	– –
NORWEGIAN SEA	7970	11	26	46	60	– –
SOUTHEAST U.S.	7980	11	23	43	59	– –
MEDITERRANEAN SEA	7990	11	29	47	– –	– –
WESTERN RUSSIA	8000	10	25	50	65	– –
NOTRH CENTRAL U.S.	8290	11	27	42	– –	– –
NORTH SAUDI ARABIA	8990	11	25	40	56	69
GREAT LAKES	8970	11	28	44	– –	– –
SOUTH CENTRAL U.S.	9610	11	25	40	52	65
U.S. WEST COAST	9940	11	27	40	– –	– –
NORTHEAST U.S.	9960	11	25	39	54	– –
NORTHEAST PACIFIC	9970	11	30	55	81	– –
ICELANDIC	9980	11	30	– –	– –	– –
NORTH PACIFIC	9990	11	29	43	– –	– –

Loran A Chain



Decca Chains

No.	Chain	Chain Code	Area
01	SOUTH BALTIC	0A	Europe
02	VESTLANDET	0E	〃
03	SOUTH WEST BRITISH	1B	〃
04	NORTHUMBRIAN	2A	〃
05	HOLLAND	2E	〃
06	NORTH BRITISH	3B	〃
07	LOFOTEN	3E	〃
08		3E	〃
09	NORTH BALTIC	4B	〃
10	NORTH WEST	4C	〃
11	TRONDELAG	4E	〃
12	ENGLISH	5B	〃
13	NORTH BOTHNIAN	5F	〃
14	SOUTHERN SPANISH	6A	〃
15	NORTH SCOTTISH	6C	〃
16	GULF OF FINLAND	6E	〃
17	DANISH	7B	〃
18	IRISH	7D	〃
19	FINNMARK	7E	〃
20	FRENCH	8B	〃
21	SOUTH BOTHNIAN	8C	〃
22	HEBRIDEAN	8E	〃
23	FRISIAN ISLAMDS	9B	〃
24	HELGELAND	9E	〃
25	SKAGERRAK	10B	〃
26	NORTH PERSIAN GULF	5C	Persian Gulf & India
27	SOUTH PERSIAN GULF	1C	〃
28	BOMBAY	7B	〃
29	CALCUTTA	8B	〃
30	BANGLADESH	6C	〃
31	SALIYAH	2F	〃
32	HOKKAIDO	9C	Japan
33	TOHOKU	6C	〃

No.	Chain	Chain Code	Area
34	KANTO	8C	Japan
35	SHIKOKU	4C	〃
36	HOKURIKU	2C	〃
37	KITA-KYUSHU	7C	〃
38	NAMAQUALAND	4A	Southrn Africa
39	CAPE	6A	〃
40	EASTERN PROVINCE	8A	〃
41	SOUTH WEST AFRICA	9C	〃
42	NATAL	10C	〃
43	DAMPIER	8E	Australia
44	PORT HEADLAND	4A	〃
45	ANTICOSTI	9C	North America
46	EAST NEWFOUNDLAND	2C	〃
47	CABOT STRAIT	6B	〃
48	NOVA SCOTIA	7C	〃

Equipment List

Complete Set

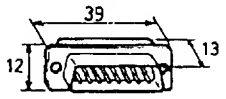
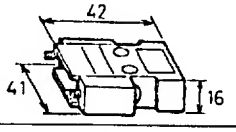
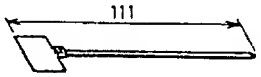
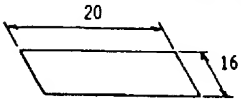
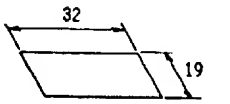
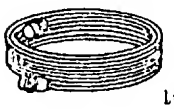
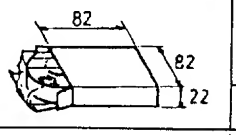
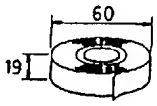
Name	Type	Qty	Wt.	Remarks	
Antenna Unit	GPA-014	1	0.5		
Display Unit	GPR-016	1	4		
Installtion Materials	CP20-00900	1		For FSA	See next pages.
	CP20-00910			Except USA	
Spare Parts	SP20-00200	1 set			
Accessories	FP20-00200	1 set			

Optional Equipment

No.	Name	Type	Code No,	Remarks
1	Antenna Adaptor	OP20-14	000-040-235	for GPA-012
2	Rectifier	PR-62		for 110/220VAC
3	Antenna Cable Set	CP20-00600	000-040-670	30m
4	Antenna Cable Set	CP20-00610	000-040-671	50m
5	Flush Mount Kit	OP20-1	004-362-070	
6	Right Angle Mounting Base	No.13-QA300	000-803-239	
7	L-angle Mounting Base	No.13-QA310	000-803-240	
8	Variable Angle Mounting Base	No.13-QA100	000-803-241	
9	Modification Kit	OP20-21	000-040-238	for GP-500
10	Antenna Unit	GPA-012	000-040-218	
11	Antenna Unit	GPA-012-F	000-040-219	for FUSA

CODE NO	000-040-233	20AH-X-9401-1
TYPE	CP20-00900	

工事材料表 INSTALLATION MATERIALS	GP-500 MARK-2	GPS航法装置 GPS NAVIGATOR (FOR USA向)	

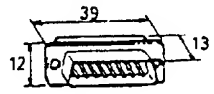
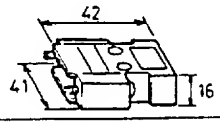
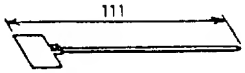
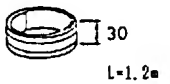
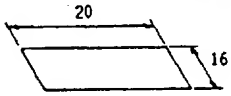
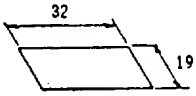
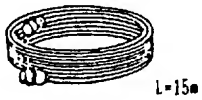
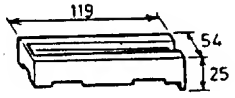
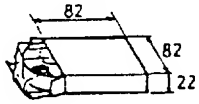
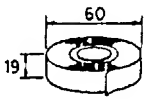
番号 No	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	Dサブコネクタ D-SUB CONNECTOR		XM2A-1501 CODE NO 000-111-706	1	受信部用 FOR MAIN UNIT
2	Dサブコネクタフード D-SUB CONNECTOR HOUSING		XM2S-1513 CODE NO 000-118-820	1	受信部用 FOR MAIN UNIT
3	ケーブルバンド CABLE CLAMP		PLF1M-M CODE NO 000-116-921	5	受信部用 FOR MAIN UNIT
4	アース銅板 COPPER STRAP		04S40801 (30X1200X0.3) CODE NO 000-572-187	1	受信部用 FOR MAIN UNIT
5	ヒューズ貼りマーク LABEL		20-004-8002-0 CODE NO 100-114-610	1	受信部用 FOR MAIN UNIT
6	ケーブル貼りマーク LABEL		20-004-8003-0 CODE NO 100-114-820	1	受信部用 FOR MAIN UNIT
7	信号ケーブル組品 SIGNAL CABLE ASSY.		MJ型6芯ケーブル付コネクタ(EV-SA 7/0.16 X2P *5M*) CODE NO 000-117-603	4	受信部用 FOR MAIN UNIT
8	電源コード POWER CABLE		22S0019 (VV0.75X2C *3M*) CODE NO 000-109-000	1	受信部用 FOR MAIN UNIT
9	アンテナケーブル組品 ANTENNA CABLE ASSY.		BBP-3D2V CODE NO 000-134-445	1	空中線部用 FOR ANT.UNIT
10	絶縁テープ SELF-BONDING TAPE		Uテープ 0.5X19X5M CODE NO 000-800-985	1	空中線部用 FOR ANT.UNIT
11	ビニールテープNO.360 VINYL TAPE		0.2X19X10000 黒 ｴｽﾛﾝ BLK CODE NO 000-835-215	1	空中線部用 FOR ANT.UNIT

CP20-00260 004-363-400

CP20-00560 004-366-360

CODE NO	000-040-234	20AH-X-9403-1
TYPE	CP20-00910	

工事材料表 INSTALLATION MATERIALS	GP-500 MARK-2	GPS航法装置 GPS NAVIGATOR	(Except USA)

番号 No	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	Dサブコネクタ D-SUB CONNECTOR		XM2A-1501 CODE NO 000-111-706	1	受信部用 FOR MAIN UNIT
2	Dサブコネクタフード D-SUB CONNECTOR HOUSING		XM2S-1513 CODE NO 000-118-820	1	受信部用 FOR MAIN UNIT
3	ケーブルバンド CABLE CLAMP		PLF1M-M CODE NO 000-116-921	5	受信部用 FOR MAIN UNIT
4	アース銅板 COPPER STRAP		04S40801 (30X1200X0.3) CODE NO 000-572-187	1	受信部用 FOR MAIN UNIT
5	ヒューズ貼りマーク LABEL		20-004-8002-0 CODE NO 100-114-610	1	受信部用 FOR MAIN UNIT
6	ケーブル貼りマーク LABEL		20-004-8003-0 CODE NO 100-114-820	1	受信部用 FOR MAIN UNIT
7	信号ケーブル組品 SIGNAL CABLE ASSY.		MJ型6芯ケーブル付コネクタ(EV-SA 7/0.16 X2P *5M*) CODE NO 000-117-603	4	受信部用 FOR MAIN UNIT
8	電源コード POWER CABLE		22S0019 (VV0.75X2C *3M*) CODE NO 000-109-000	1	受信部用 FOR MAIN UNIT
9	アンテナケーブル組品 ANTENNA CABLE ASSY.		BBP-3D2V CODE NO 000-134-445	1	空中線部用 FOR ANT.UNIT
10	バークランプ HOSE CLAMP		2672 SUS304 CODE NO 000-803-218	1	空中線部用 FOR ANT.UNIT
11	取付補助具 INSTALLING SPACER		20-005-3101-0 CODE NO 100-150-540	1	空中線部用 FOR ANT.UNIT
12	絶縁テープ SELF-BONDING TAPE		Uテープ 0.5X19X5M CODE NO 000-800-985	1	空中線部用 FOR ANT.UNIT
13	ビニールテープNO.360 VINYL TAPE		0.2X19X10000 黒 エスロン BLK CODE NO 000-835-215	1	空中線部用 FOR ANT.UNIT

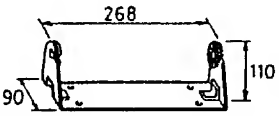
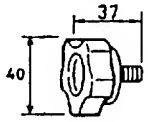
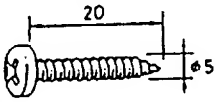
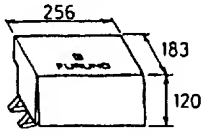
CP20-00260
004-363-400

CP20-00550
004-366-350

CODE No.	000-040-153	20AB-X-9501-3
TYPE	FP20-00200	

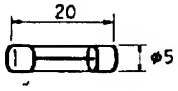
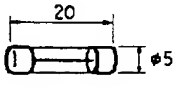
付属品表 ACCESSORIES	GP-500/500H GP-500 MARK-2	GPS航法装置 GPS NAVIGATOR

004-362-050
FP20-00220

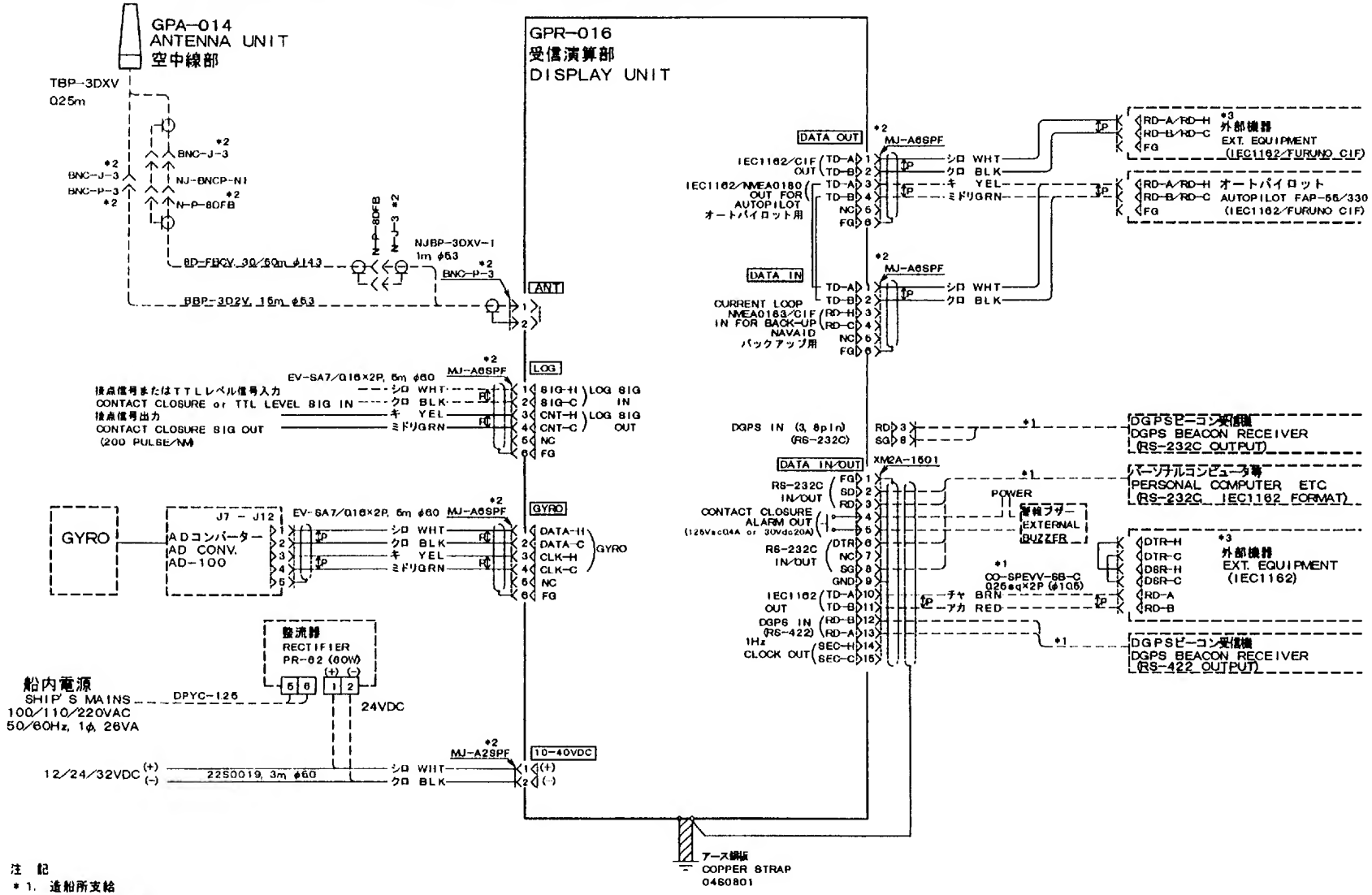
番号 No.	名称 NAME	略図 OUTLINE	型名／規格 DESCRIPTIONS	数量 Q'TY	用途／備考 REMARKS
1	ハンガー組品 HANGER BRACKET ASSY.		FP20-0210 N1.0 半ツヤ CODE No. 004-362-040	1	
2	ノブボルト KNOB BOLT ASSY.		KG-B2 M8 × 20 SUS CODE No. 000-800-601	2	
3	小型丸平座金 FLAT WASHER		M8 SUS304 CODE No. 000-800-917	2	
4	⊕ナベタッピンUIネジ TAPPING SCREW		5 × 20 SUS304 CODE No. 000-800-488	4	
5	磨き平座金 FLAT WASHER		M5 SUS304 CODE No. 000-864-128	4	
6	ビニールカバー VINYL COVER		20-004-2301-0 CODE No. 000-801-903	1	

CODE NO.	000-040-150	20AB-X-9301-4
TYPE	SP20-00200	BOX NO. P

SHIP NO.	SPARE PARTS LIST FOR	U S E	SETS PER VESSEL
	GP-500/500H GP-500 MARK-2 GP-500H MARK-2 GPS航法装置 GPS NAVIGATOR		

ITEM NO.	NAME OF PART	OUTLINE	DWG. NO. OR TYPE NO.	QUANTITY WORKING PER SET	QUANTITY WORKING PER VES.	QUANTITY SPARE	REMARKS/CODE NO.
1	ミゼットヒューズ GLASS TUBE FUSE		FGMB 2A AC125V	1		3	000-103-165
2	ミゼットヒューズ GLASS TUBE FUSE		FGMB 3A AC125V	1		3	000-104-909

FURUNO



注 記
* 1. 造船所支給
* 2. 工場にて接続済
* 3. DTRとDSR端子が備わっているときは、それらを接続すること。

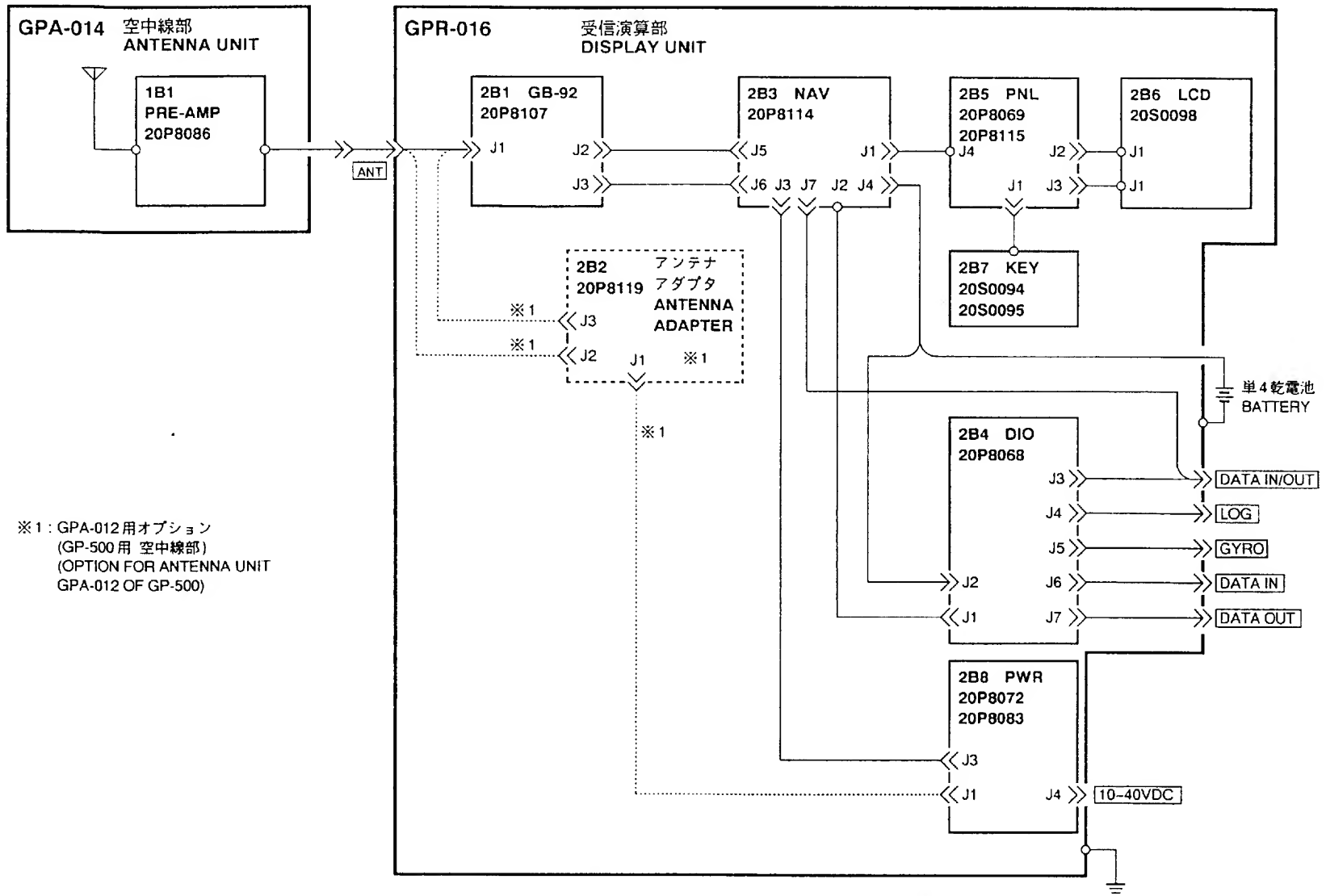
NOTE
*1. SHIPYARD SUPPLY.
*2 FITTED AT FACTORY.
*3 JUMP BETWEEN DTR AND DSR IF PROVIDED.

DRAWN Sep. 4 '97 T. YAMAZAKI		TITLE	GP-500 MARK-2
CHECKED Sep.9'97 K. KUSUNOKI		名称	GPS航法装置
APPROVED Sep.10'97 H. Yamaguchi			相互結線図
SCALE	MASS kg	NAME	GPS NAVIGATOR
DWG No. C4355-C01- G			INTERCONNECTION DIAGRAM

FURUNO ELECTRIC CO., LTD.

S-1

FURUNO

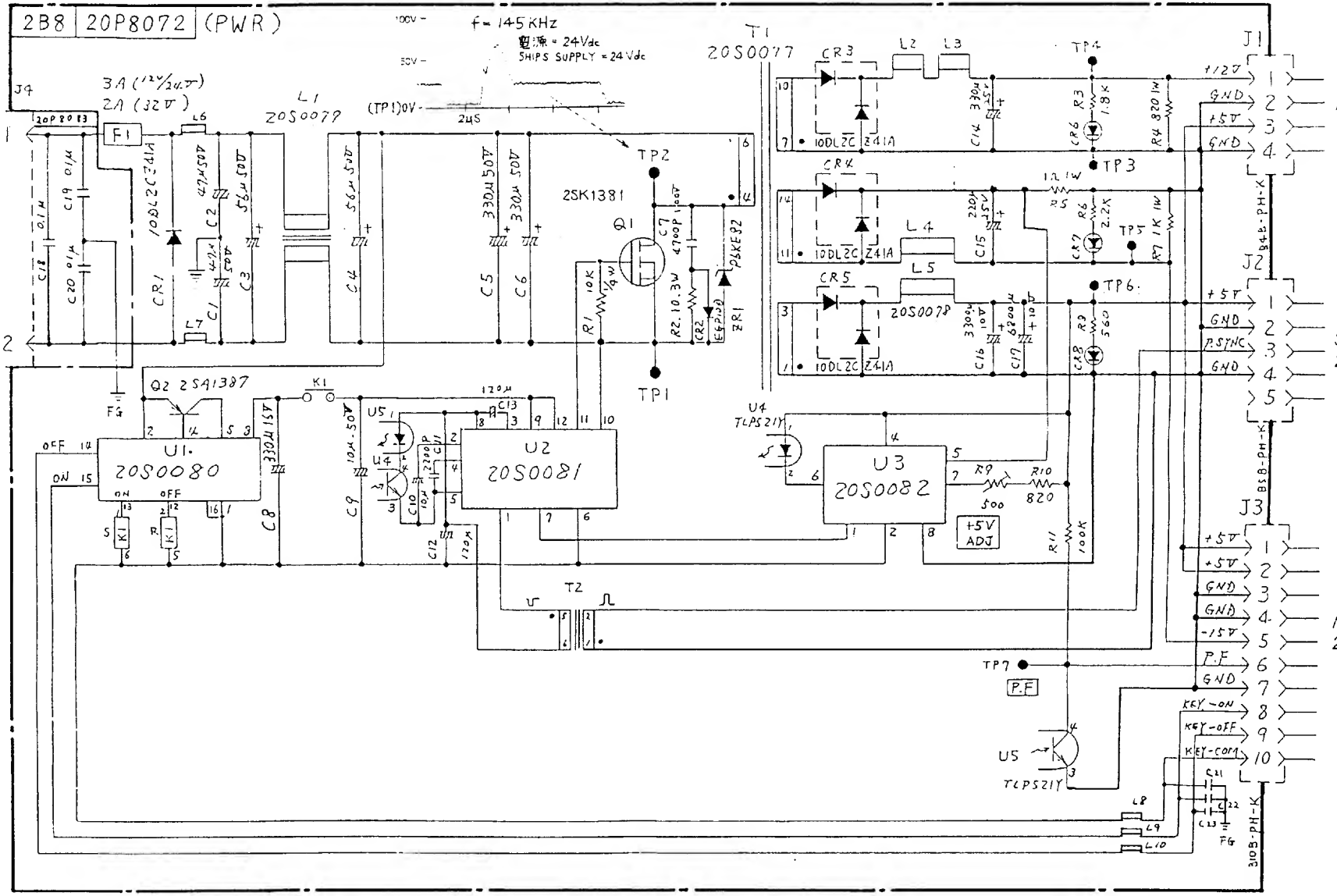


※1：GPA-012用オプション
(GP-500用 空中線部)
(OPTION FOR ANTENNA UNIT
GPA-012 OF GP-500)

ITEM	NAME	MATERIAL	Q'TY	DWG. NO.	REMARKS

承認 APPROVED	Jan·29·'93 M.IKEDA	三角法 THIRD ANGLE	名称 TITLE: 総合回路図 GP-500 MARK-2 GENERAL SCHEMATIC DIAGRAM
検図 CHECKED	Jan·29·'93 I.AMANO	尺度 SCALE	
製図 DRAWN	JAN·29·'93 TAKAHASHI	重量 WEIGHT kg	図番 DWG.NO C4355-K01-A

FURUNO



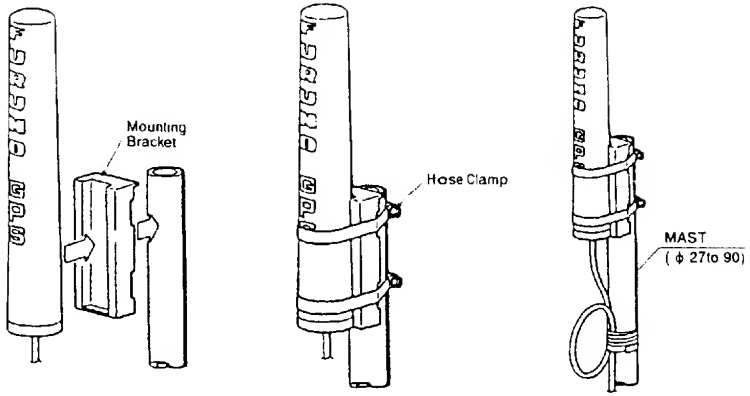
承認 APPROVED	NOV・8・'89 T.NAKANO	名称 TITLE	PWR基板 PWR BOARD
検図 CHECKED	NOV・8・'89 N.SAITO	20P8072	
製図 DRAWN	NOV・8・'89 T.YUYAMA	DWG.NO.	C4312 – K01 – B

GP-500
GP-500 MARK-2

FURUNO ELECTRIC CO., LTD.

FURUNO

1)FIXED TO MAST

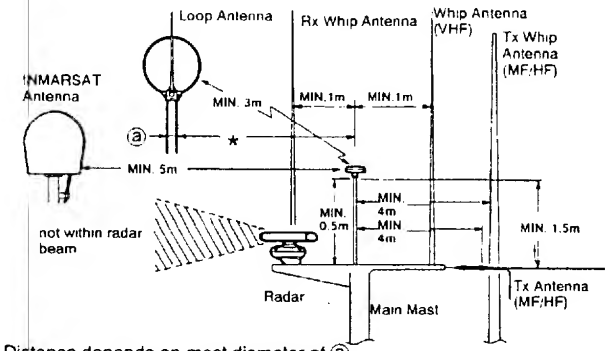


After connecting antenna cable, waterproof the connector by wrapping it with self-bonding tape and then vinyl tape.

Tape antenna cable to mast as shown above.

Mounting location

The figure below shows the recommended separation distances from other antennas to avoid mutual interference.

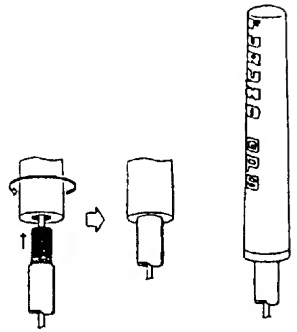


* Distance depends on mast diameter of ⓐ
ⓐ mast diameter 10cm : minimum 1.5m
ⓐ mast diameter 30cm : minimum 3m

2)SCREWED INTO THREADED PIPE

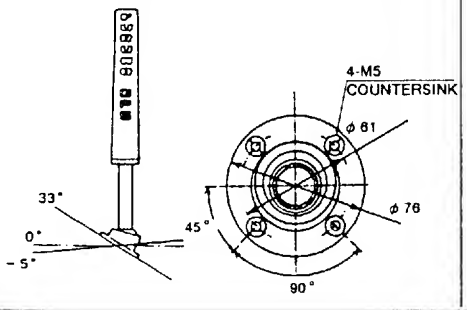
Thread Type	Threads per 25.4 mm (1 inch)	Pitch	Pitch Diameter
1 x 14UNS	14	1.8143	24.15

After connecting antenna cable, waterproof the connector by wrapping it with self-bonding tape and then vinyl tape.



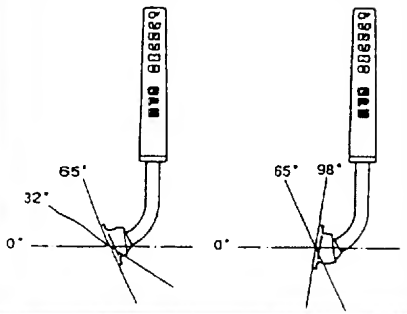
3)RIGHT ANGLE MOUNTING BASE (Option)

Type No.13-QA300、Code No.000-803-239



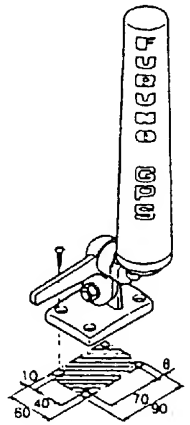
4)L-ANGLE MOUNTING BASE (Option)

Type No.13-QA310、Code No.000-803-240

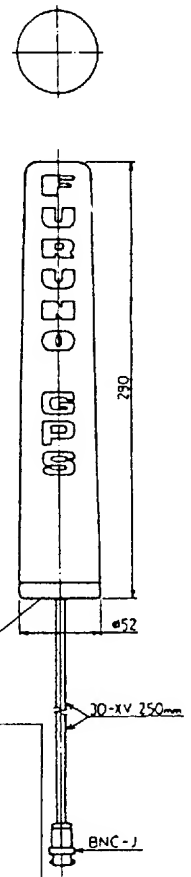


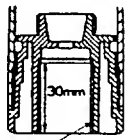
5) VARIABLE ANGLE MOUNTING BASE

Type No.13-QA100、CodeNo.000-803-241



ANTENNA UNIT
GPA-014





WHITWORTH FINE THREAD W25-14

NOTE:
Substitutable with UNIFY THREAD (1-14 UNS).

REMARKS		TYPE	GPA014
DRAWN: E.M APPROVED	GP188 GP3100 GP500MK2 GP70MARK2	NAME	INSTALLATION DIAGRAM
SCALE / MASS kg	APPLICABLE TO: (MODEL) / BLOCK NO.	DWG NO.	E4352-Y01- A

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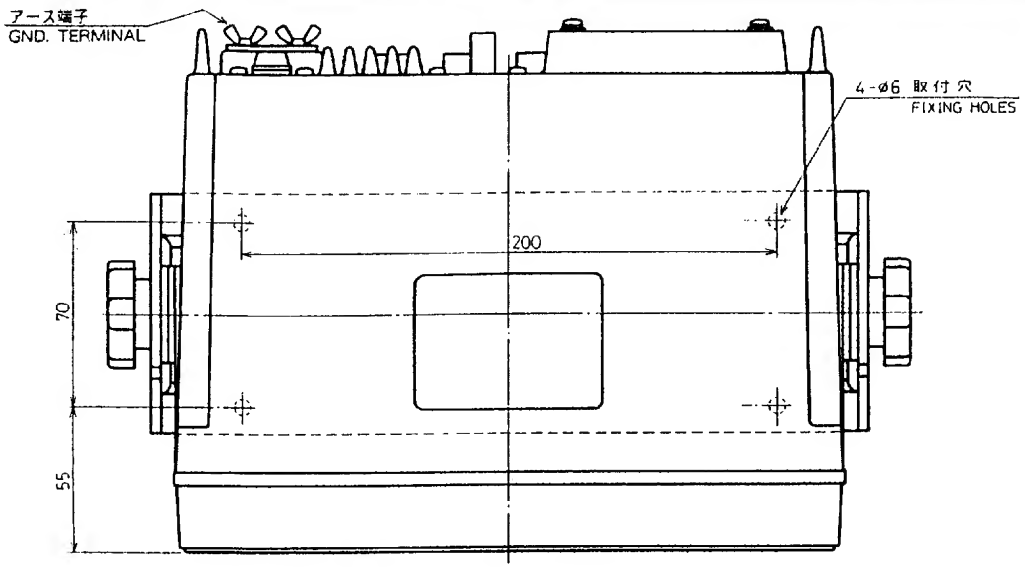

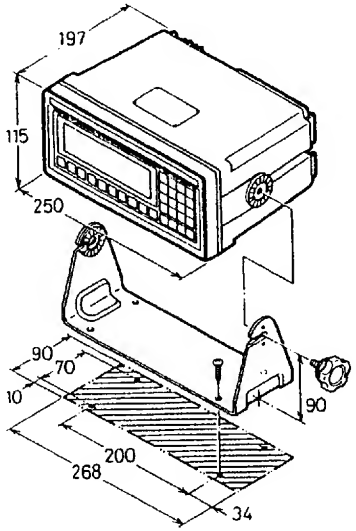

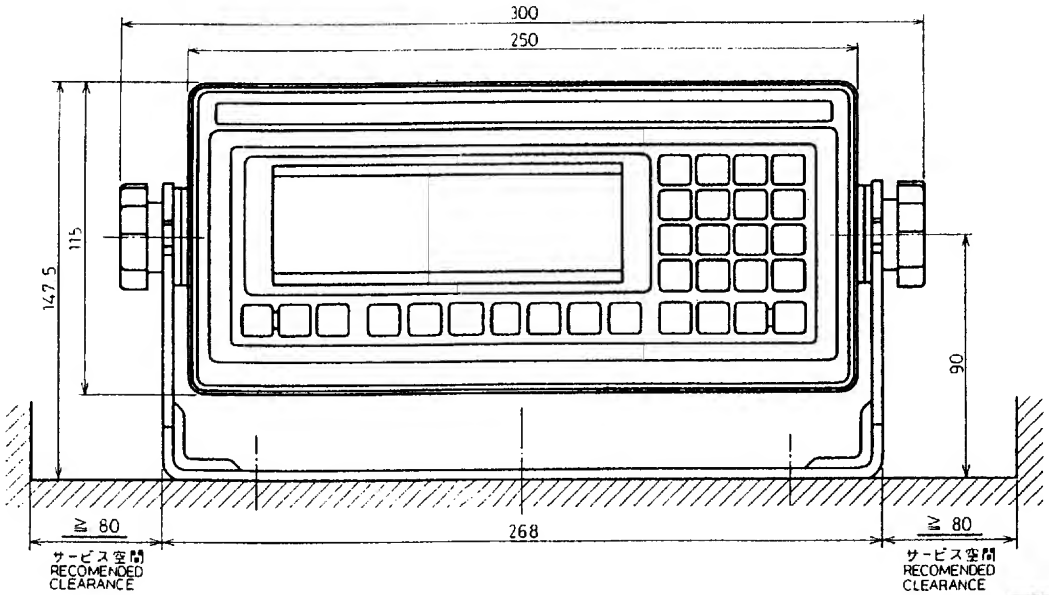

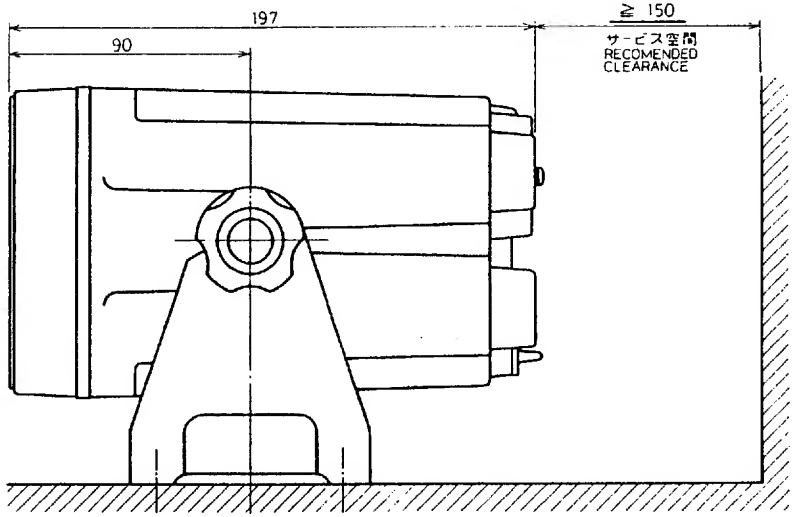

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	JUL・26・'97 T. NAKANO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	GPR-016 GPR-013
検図 CHECKED	JUL・26・'97 T. YUYAMA	尺度 SCALE	1/2		
製図 DRAWN	JUL・25・'97 N. SAITO	重量 WEIGHT	4 kg	図番 DWG.NO.	C4312-G01-D

受信演算部外寸図
MAIN UNIT

GP-500 MARK-2
GP-500

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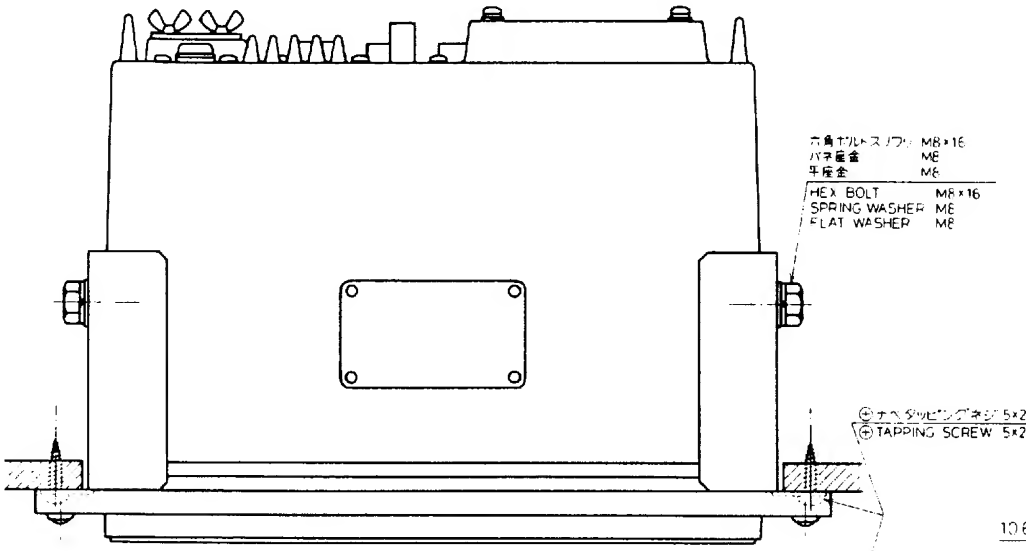
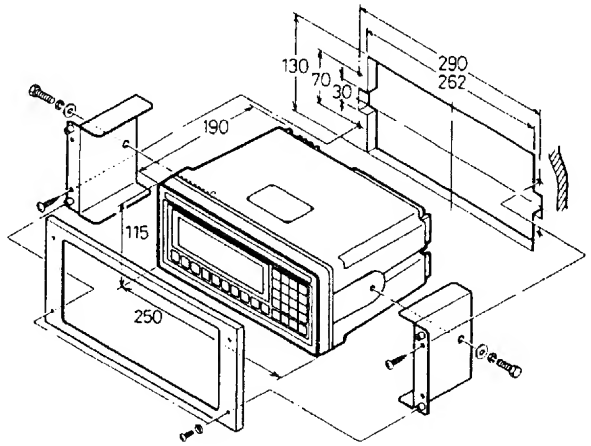
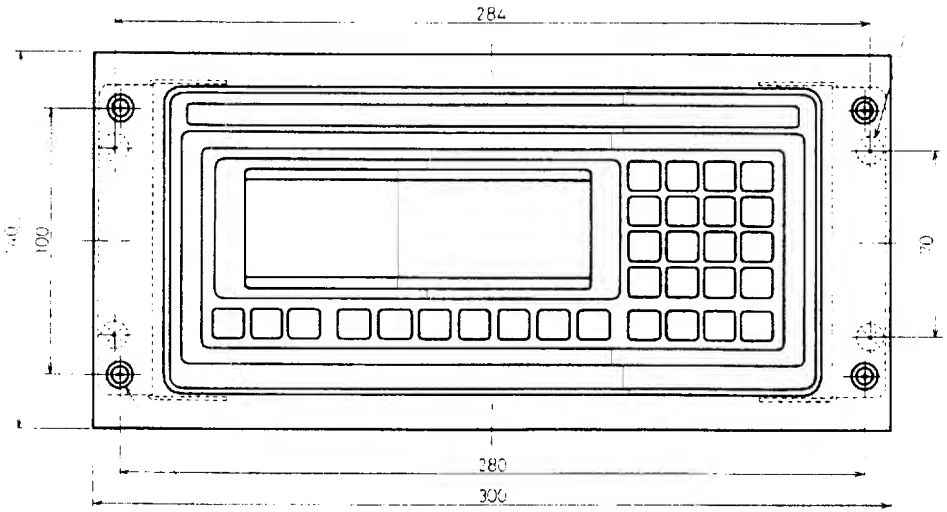
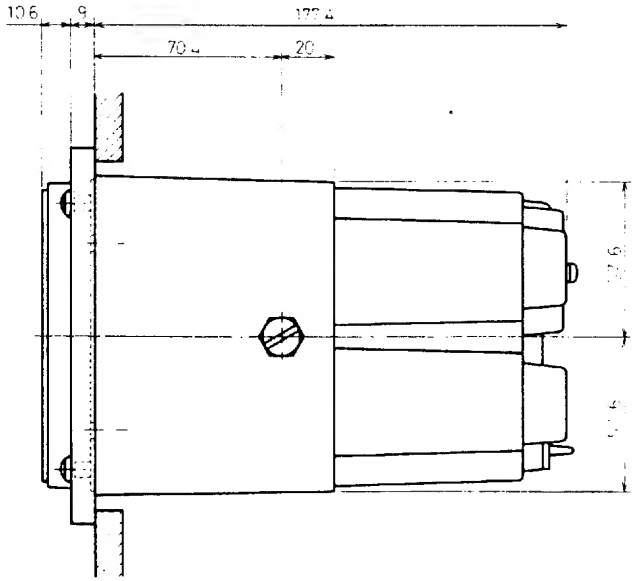
C-7

FURUNO









⊕マルサラコラス M3×8, ローゼット座金 M3
⊕OVAL HEAD SCREW M3×8, ROSETTE WASHER M3

ITEM	NAME	MATERIAL	Q'TY	DWG NO	REMARKS

承認 APPROVED	Nov. 6. '89 T. NAKAJIC	三角法 THIRD ANGLE PROJECTION	名称 TITLE GPR-016 GPR-013 フラッシュマウント外寸図 FLUSH MOUNT (OP20-1)
検図 CHECKED	NOV. 6. '89 T. YUYAMA	R 度 SCALE 1 ?	
製図 DRAWN	Nov. 6. '89 K. SAITO	重量 WEIGHT 4.1 kg	図番 DWG NO. C4312-G02-C

GP-500 MARK-2
GP-500

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FURUNO ELECTRIC CO., LTD.
9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan
Tel: +81 798-65-2111 Fax: +81 798-65-4200

Pub NO. DOC-229

Declaration of conformity to type

We FURUNO ELECTRIC CO., LTD.

(Manufacturer)

9-52 Ashihara-Cho, Nishinomiya City, 662-8580, Hyogo, Japan

(Address)

hereby declare under our sole responsibility that the product

Marine GPS navigator model GP-500 MARK-2 consisting of Display unit GPR-016 and Antenna unit GPA-014

(Model names, type numbers)

to which this declaration relates conforms to the following standard(s) or normative document(s)

EN 61108-1: June 1996 (IEC 61108-1: 1996-06)
EN 61162-1: November 1995 (IEC 61162-1: 1995-11)
EN 60945: January 1997 (IEC 60945 Third edition: 1996-11)

(title and/or number and date of issue of the standard(s) or other normative document(s))

For assessment, see EC type-examination certificate N° KCS/99212017/AA/00 of 3 June 1999 issued by KCS Certification, The Netherlands

This declaration is issued according to the provisions of European Council Directive 96/98/EC on marine equipment modified by Commission Directive 98/85/EC.

On behalf of Furuno Electric Co., Ltd.

Hiroaki Komatsu
Manager,
International Rules and Regulations

Nishinomiya City, Japan
June 16, 1999

(Place and date of issue)

(name and signature or equivalent marking of authorized person)